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**BAY AREA TRANSPORTATION BLUEPRINT
FOR THE 21ST CENTURY
EVALUATION REPORT
JUNE 2000**



METROPOLITAN
TRANSPORTATION
COMMISSION

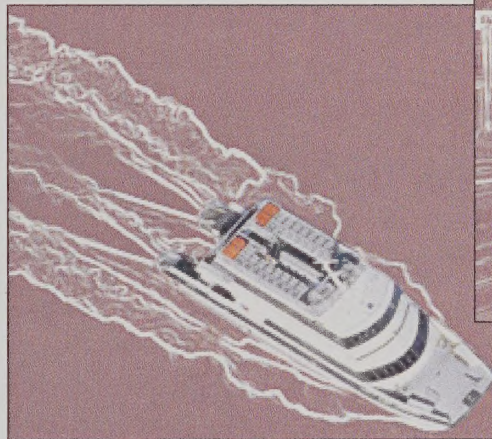


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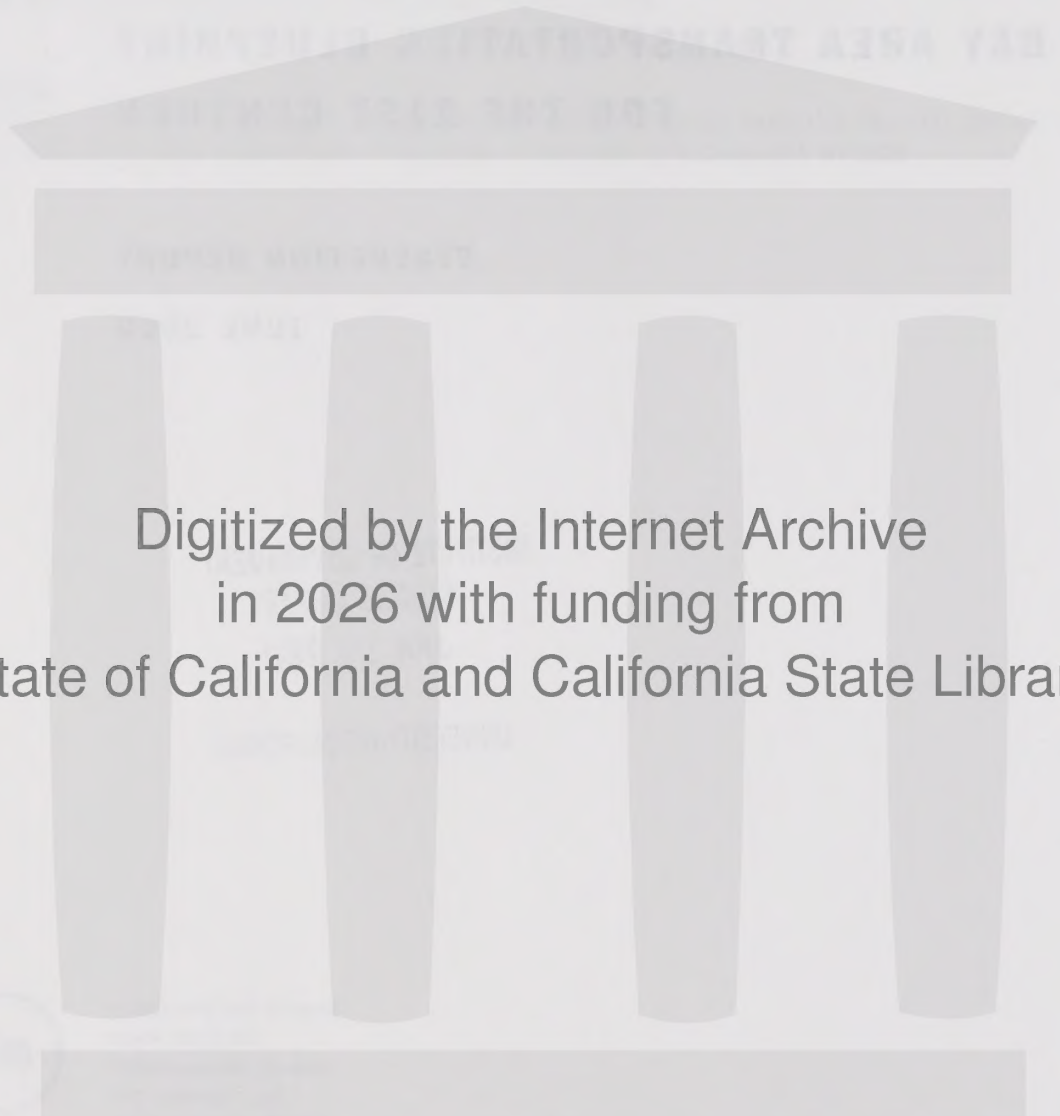
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CHAPTER 1

INTRODUCTION

INTRODUCTION

As part of the development of the *Bay Area Transportation Blueprint for the 21st Century*, the Metropolitan Transportation Commission (MTC) has collected information on a number of transportation projects that are of interest to local transportation agencies and the general public. This information includes project definition, project background, costs (in various levels of detail), and key project issues. Most of this information has been published in an earlier draft version of this report dated February 2000 and in the *Blueprint Project Notebook* dated June 2000 (a draft was released in October 1999).

This report focuses on evaluating transportation projects that would expand the capacity of the region's transportation system to address projected growth in regional population and employment between now and 2020. In general, these projects have not been included in MTC's *1998 Regional Transportation Plan* (RTP), due to projected funding constraints and adopted regional funding priorities. Although a number of other programs are also being considered for inclusion in the Blueprint (e.g., funding for seismic retrofit and system maintenance shortfalls, highway and transit management strategies, bicycle facilities, welfare to work, and MTC's Transportation for Livable Communities Program), these programs are not part of this evaluation.

This report assesses the impact of candidate Blueprint projects on the performance of the regional transportation system. This evaluation is carried out at two levels:

- Evaluation of packages of projects (Rail, Rapid Bus, Ferry, and Roads)
- Evaluation of individual Blueprint projects, many of which are components of the packages above

Our evaluation covers a number of areas:

- A review of projected travel patterns in the Bay Area in 2020 and the identification of corridors where travel is expected to increase the fastest
- Changes in travel times afforded by candidate Blueprint projects
- Changes in transit use (particularly the potential of candidate projects to generate "new" transit riders)
- Changes in vehicle trips and delay
- Changes in demand/capacity ratios at various locations on the highway system
- Costs (both capital and operating)
- Cost effectiveness (costs compared to number of users)

This report will remain a "work in progress" and it can be amended as more updated information becomes available. Specifically, we believe the accuracy of the costs for many projects can be significantly improved, and we are still learning of new projects that may be proposed for inclusion in future county transportation sales tax measures.

REPORT ORGANIZATION

This report contains the following chapters:

- Chapter 2.** We present information on changing travel patterns in the Bay Area, including the growing impact of trips from outside the region. The intent of this chapter is to provide an indication of where major travel demand will occur in the region and to link this information with the Blueprint projects that can potentially respond to this demand.
- Chapter 3.** As part of our initial work on the Blueprint, MTC defined a series of trunkline transit “packages” to test the impact of major investments in one or more transit modes: rail, rapid bus, and ferry. These packages were presented at the public outreach meetings conducted by MTC in November/December 1999. During these meetings, we indicated that the Blueprint would most likely include some combination of modal projects based on a corridor-by-corridor analysis. Evaluation information for the packages is presented at a regional level. This Chapter also includes the results of our land use and pricing “sensitivity” tests.
- Chapter 4.** This chapter evaluates a number of individual transit projects according to the number of “new transit riders” generated, costs, and cost effectiveness. Information on new transit riders is derived from the travel demand forecasts for the packages described above, whereas the cost information was developed as part of the *Blueprint Project Notebook* (revised June 2000).
- Chapter 5.** This chapter evaluates a subset of highway projects in the region, including mixed-flow lane projects and new carpool lanes. The carpool lane projects were modeled as part of the Rapid Bus Package above. The mixed-flow lane projects were selected because: a) they are part of a past or ongoing corridor study, or b) because they are of interest to entities developing new sales tax plans in various counties.
- Appendix.** The Appendices contain additional information on transit ridership at the transit operator level and on projected highway volumes at various regional “screenlines” in 2020.

CHAPTER 2

THE BAY AREA'S CHANGING TRAVEL PATTERNS: 2000 TO 2020

Projected population, employment, and trip growth for the region is shown in Figure 1. The fastest growing Bay Area counties are located in the North Bay, while most counties bordering the region exhibit triple-digit growth rates in population between 2000 and 2040 (see Figure 2). Given current trends, many more residents in these counties will hold Bay Area jobs in the future, contributing to increased travel demand at the region's gateways (see Figure 3).

Bay Area travel patterns will change significantly in the future as well. Figure 4 pulls the Bay Area and inter-regional trip patterns together by ranking the increase in commute trips in three categories:

- Counties whose internal trips are increasing the fastest (trips that begin and end in the same county)
- Trips between MTC Super Districts (of which there are 34)
- Trips from outside the Bay Area

Figure 5 examines changes in regional demographic and transportation indicators between 2000 and 2020. Percent change in vehicle hours of delay far surpasses all other measures with a 160% increase. Workers residing outside the Bay Area also increase rapidly (+43%), as does average household income (+29%).

These measures are in many ways closely related. Rising incomes help to fuel the rise in housing costs, which in turn forces many persons who would desire to live in the Bay Area to look to neighboring counties for affordable housing. This in turn puts pressure on the gateways into the Bay Area where capacity (both road and transit) is limited.

At the lower end of the scale, population growth and transit usage each increase by +14%, followed closely by vehicle passengers (carpoolers) at +17%.

Another way to look at changes in Bay Area travel patterns is to look at the changes in trips occurring across so-called "screenlines" (see Figure 6).

Our projects show that the location experiencing the greatest number of new trips will be the San Francisco-San Mateo County line. Travel today is already heaviest across this screenline, which is served by numerous local streets and roads, and multiple regional freeways, rail lines and bus lines. The variety and concentration of transportation facilities in the area exceeds that of any other screenline.

In percentage terms, the Altamont Pass is projected to grow fastest, followed by Napa-Vallejo, the Benicia Bridge and the Solano/Yolo County Line. The Altamont Pass is particularly significant because it combines a large numerical change (#2) with a high percentage rate (#1).

It is important also to note the significant locational differences among screenlines. Travel across a screenline in a relatively remote location—such as the Altamont Pass—consists mostly of long-distance trips. However, in areas with greater population density and numerous local roads and highways—such as the San Francisco-San Mateo County line—trips can vary in length from very short to very long. One traveler may be making a two-block run to the store for a gallon of milk, while another may be commuting from San Francisco to San Jose.

Figure 1
Regional Demographic and Transportation Indicators – 2000 and 2020

Demographic Characteristics	2000	2020	Change	% Change
Bay Area Population	6,824,200	7,774,400	950,200	14%
Bay Area Employed Residents (Workers)	3,393,300	4,202,400	809,100	24%
Bay Area Employment (Jobs)	3,460,040	4,373,600	913,560	25%
Workers Residing Outside Bay Area	174,000	249,000	75,000	43%
Mean Household Income (\$1995)	74,700	96,700	22,000	29%

Regional Person Trips				
Purpose	2000	2020	Change	% Change
Total Person Trips				
Vehicle Driver	12,623,600	14,660,500	3,036,900	24%
Vehicle Passenger	4,393,100	5,138,500	745,400	17%
Transit	1,382,100	1,582,500	199,300	14%
Non-Motorized	2,104,000	2,334,600	443,486	23%
Total Modes	20,503,400	24,715,560	4,212,250	21%

ABAG Projections 98 was used for the Blueprint analysis.

Figure 2

Bay Area Growth 2000 - 2020

Percentage Change

Population/Employment

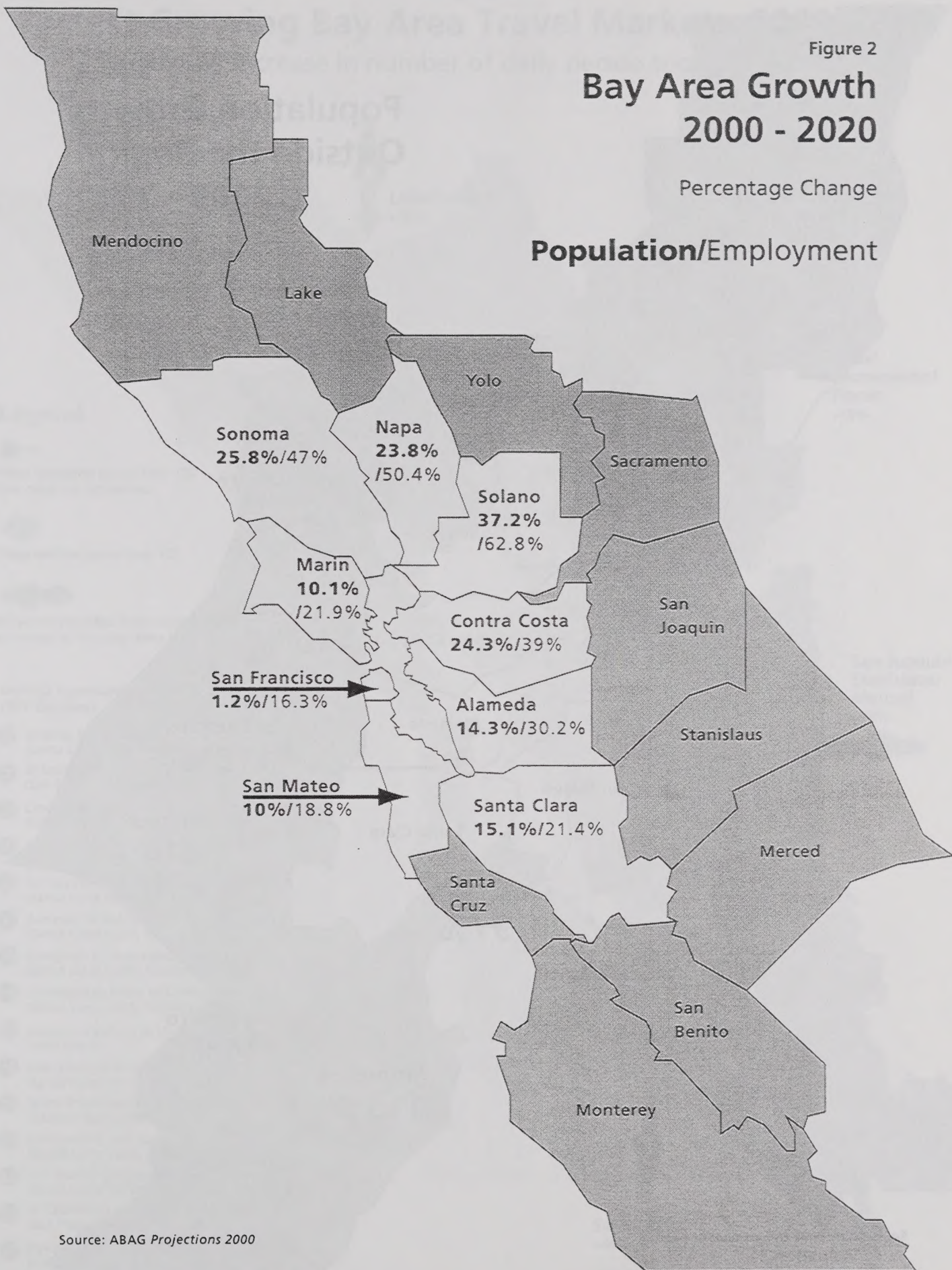


Figure 3

Population Growth Outside the Region 2000 - 2040

(Percentage Change)

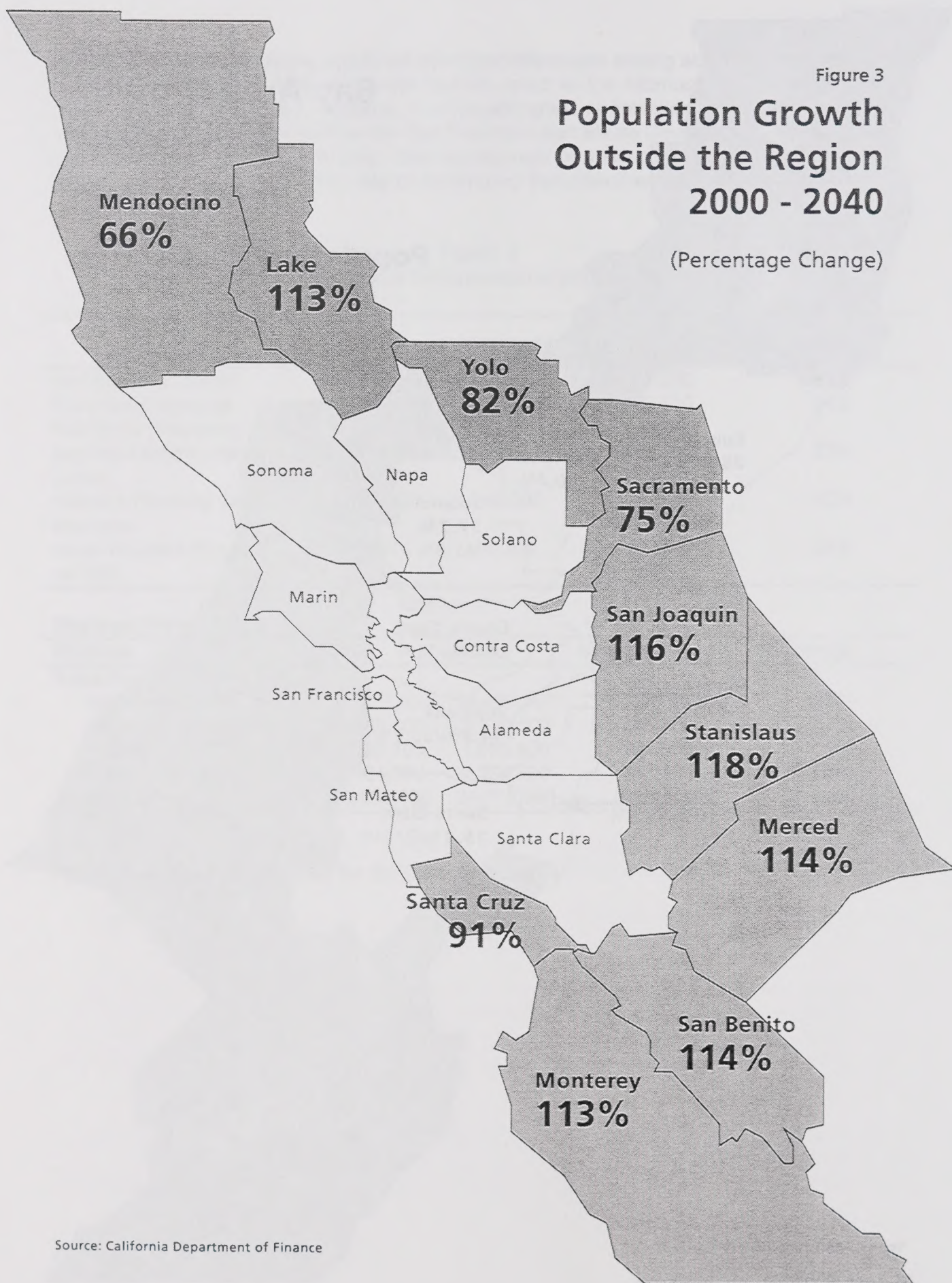


Figure 4

Fastest-Growing Bay Area Travel Markets, 2000–2020

Ranked by increase in number of daily person trips (2000–2020)

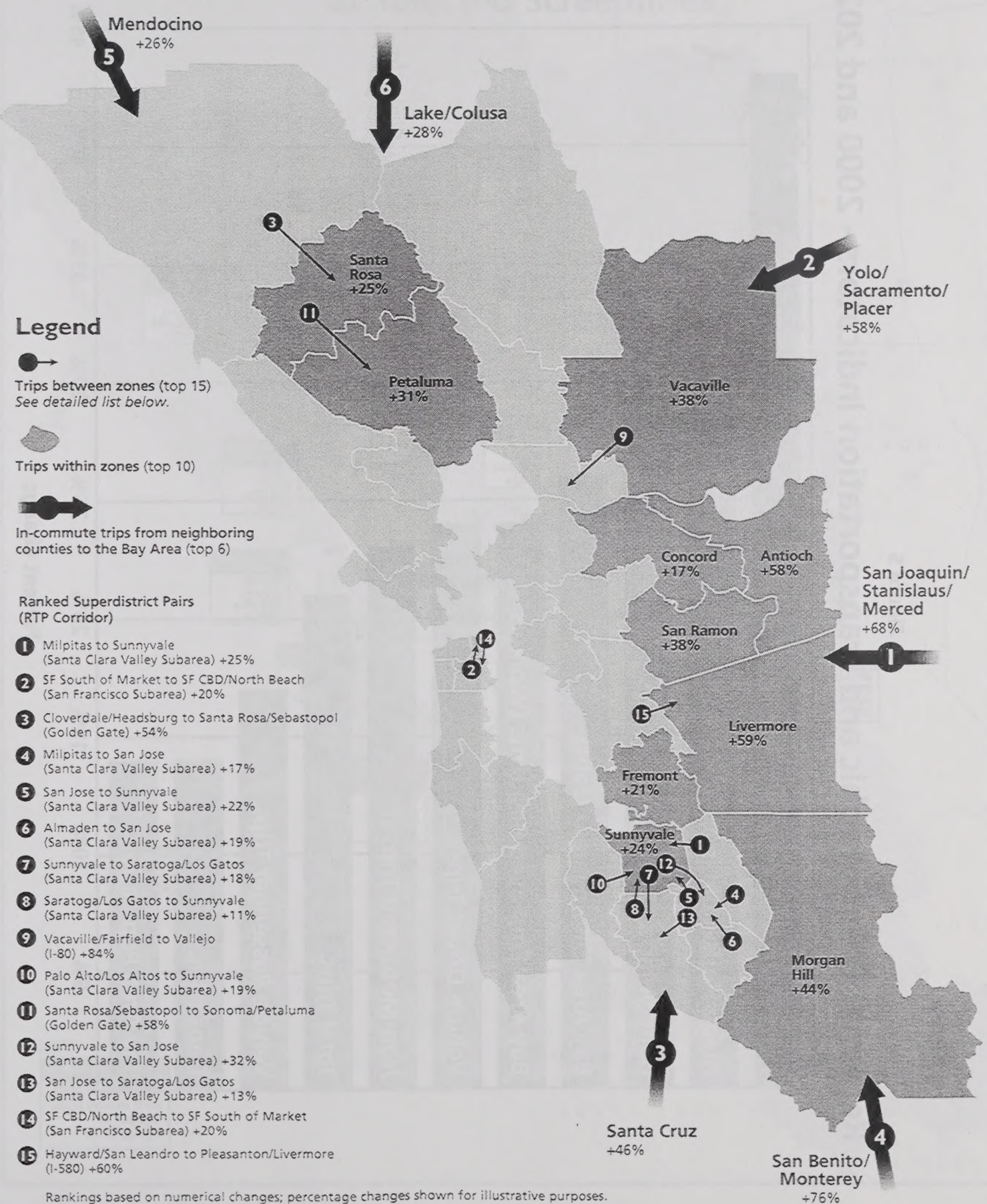


Figure 5

Regional Demographic and Transportation Indicators - 2000 and 2020

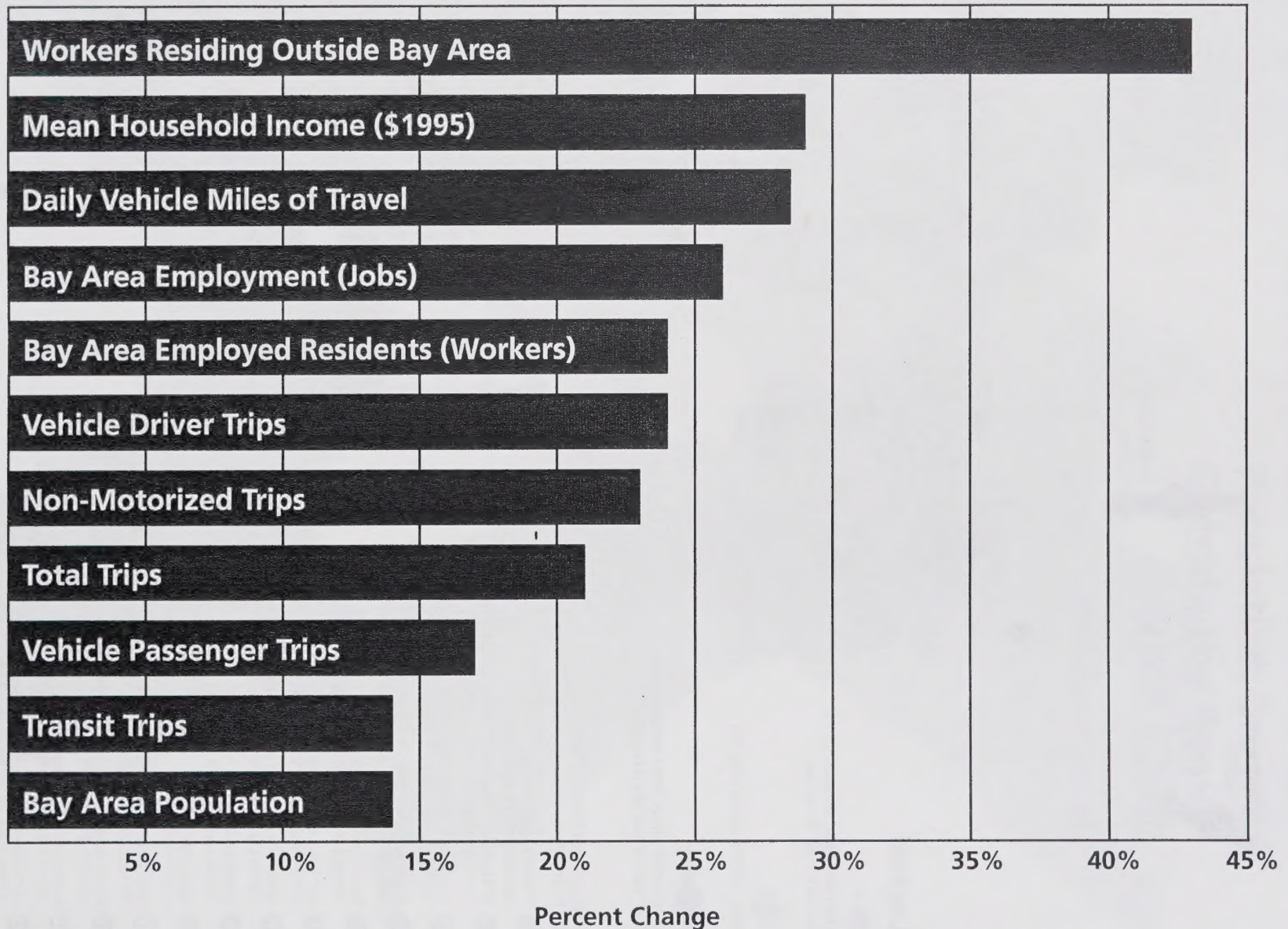
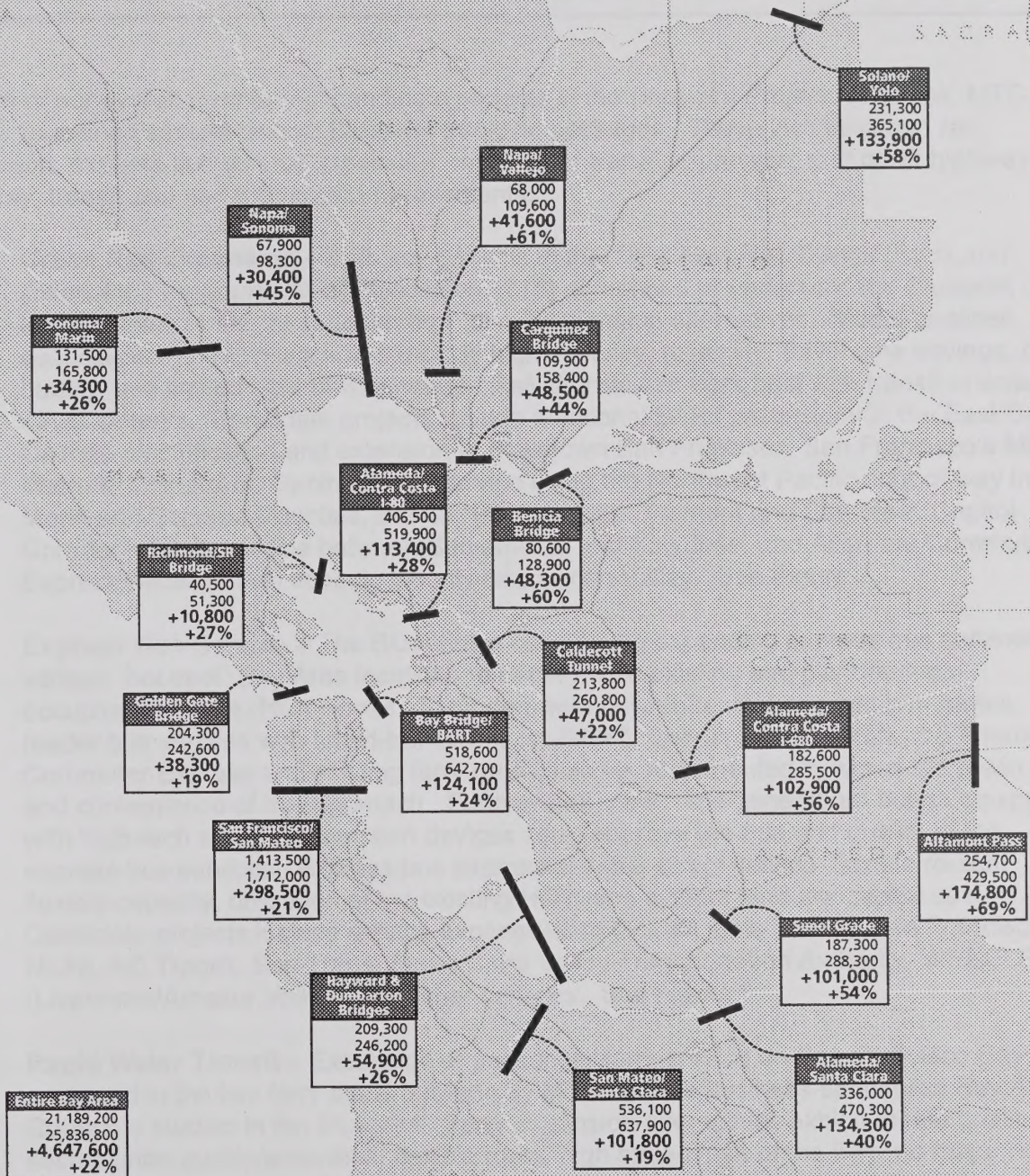


Figure 6

Change in Daily Person Trips at Selected Screenlines



KEY

Screenline
2000 Person Trips
2020 Person Trips
Change
% Change

CHAPTER 3

BLUEPRINT PACKAGES

As part of our overall inventory of candidate projects in the *Blueprint Project Notebook*, MTC closely examined several distinct Blueprint trunkline packages. These include urban rail expansion, express bus service expansion, rapid water transit expansion, and other highway, roadway, transit and non-motorized improvements.

Urban Rail Expansion – With key projects in the *1988 New Rail Transit Starts and Extensions Programs* (MTC Resolution 1876) completed or underway, the Blueprint is looking towards the “next generation” of rail expansion alternatives. Modal qualities associated with rail alternatives include high capacity, reliability, travel time savings, ride quality, and limited right of way needs. Rail alternatives work best with transit-oriented developments. Candidate projects include additional BART extensions in the East Bay, Caltrain electrification and extension to downtown San Francisco, San Francisco’s MUNI Metro to Chinatown, commuter rail service using the Northwest Pacific right of way in Marin and Sonoma Counties, the rail “gap” between Fremont and San Jose, Capitol Corridor intercity rail line between Sacramento and San Jose, and Altamont Commuter Express between San Joaquin County and Silicon Valley. See Figure 7.

Express Bus Service – The Blueprint is considering expanding express bus services at various “hot spot” Bay Area locations to better utilize existing and planned high-occupancy vehicle (HOV) lanes. In tandem with new/enhanced express bus routes, feeder bus shuttles with timed-transfers from BART, Caltrain, the Capitols, the Altamont Commuter Express and existing ferry runs could be implemented to widen the reach and convenience of this approach. Furthermore, new “next generation” buses equipped with high-tech signal pre-emption devices could improve the ride and quality of the express bus services. Express bus alternatives offer direct service, flexible routes, flexible capacity, utilization of the existing HOV-lane system, and low capital cost. Candidate projects include service expansions to Golden Gate Transit, San Francisco MUNI, AC Transit, SamTrans, Santa Clara Valley Transportation Authority, WHEELS (Livermore/Amador Valley), and other services. See Figure 8.

Rapid Water Transit – Expansion of passenger ferry service on San Francisco Bay as proposed in the two ferry plans put forth by MTC and the business-sponsored Bay Area Council is studied in the Blueprint. Ferry expansion alternatives exhibit modal qualities such as ride quality/amenities, flexible route, high speed, use of the Bay, no major right of way requirements, and low capital cost. Ferry expansions include adding high-speed vessels on existing routes, new ferry lines, and other landside improvements to support ferry operations. Candidate projects include service upgrades on the Larkspur to San Francisco route, Vallejo to San Francisco route, Richmond to San Francisco route, and Sausalito/Tiburon to San Francisco routes as well as new ferry terminals in Berkeley/Albany, Port Sonoma, and South San Francisco and the San Francisco and Oakland international airports. See Figure 9.

Highway/Roadway/Transit/Non-Motorized Improvements – Shortfalls in local streets and roads that remain after the 1998 *Regional Transportation Plan* are to be addressed in the Blueprint. Selected roadway expansion and interchange improvements, seismic safety retrofits (e.g., BART and local bridges) and targeted programs like MTC's innovative Transportation for Livable Communities and "lifeline" transit service proposals to aid people in transition from welfare to work are also being considered. Others such as traffic operation systems, a universal transit ticketing system, local transit service region wide to local employment and school sites, earthquake preparedness, and regional bicycle and pedestrian facilities are also important Blueprint projects. See Figure 10.

A variety of measures are compared for each trunkline transit package in Figure 11. This table examines capital and operating costs, as well as operating subsidies. In addition, changes in transit capacity, transit riders, transit shares, vehicle miles of travel, and vehicle hours of delay are examined. On the environmental side, air quality effects and energy consumption are shown. The bottom of the table compares annualized capital costs per new rider and operating subsidy per new rider (a new rider is a rider attracted out of autos and into transit). Figure 12 shows the individual projects that contributed to these numbers.

Figure 13 compared RTP and Blueprint AM peak-hour travel times between selected cities. Generally, car pool times are fastest, followed by drive-alone times, and transit times are slowest. In a few cases, transit times are actually faster than driving, or competitive (within 25% of drive times). Examples shown include Concord and Livermore to San Francisco.

For the transit packages, significant decreases in travel times are associated with the Caltrain upgrade in the Rail Alternative (Gilroy to San Jose and Palo Alto to San Francisco), BART to Livermore (Livermore to San Francisco), Larkspur Ferry improvements (San Rafael to San Francisco), BART to San Jose (Fremont to San Jose) or light-rail transit (LRT) to Fremont (Union City to Lockheed).

In addition to the main Blueprint packages, MTC also undertook two important sensitivity analyses – one a revised land use alternative, and a second that assessed a work-trip parking charge. For the land use alternative, a uniform percentage growth rate was applied throughout the region. For the whole Bay Area, Year 2020 total population and employment growth remains the same. However, the existing built-up areas would experience more growth and the less urbanized areas would experience less growth than being projected by the Association of Bay Area Governments (ABAG) under this test. The results of this test are much greater transit usage (up 9.5%) and relatively little change in vehicle hours of delay (see Figure 14). Although these results may seem somewhat incongruous at first glance, they do make sense. Adding more people and jobs into the existing urban centers means better access to transit – thus the increase in transit usage. However, this also means a lot more travel on urban freeways – which are typically the most overburdened by congestion.

The second test assessed a \$2.60 per day parking charge for all work trips in the Bay Area. This test showed some growth in transit trips (+2.7%), but far lower growth than the land use test. Vehicle hours of delay, on the other hand, decreased by 10% under the parking charge alternative, reflecting an increase in transit and carpooling for work trips and the resulting improvement in travel speed.

Figure 7

Bay Area Transportation Blueprint for the 21st Century

Rail Expansion Projects

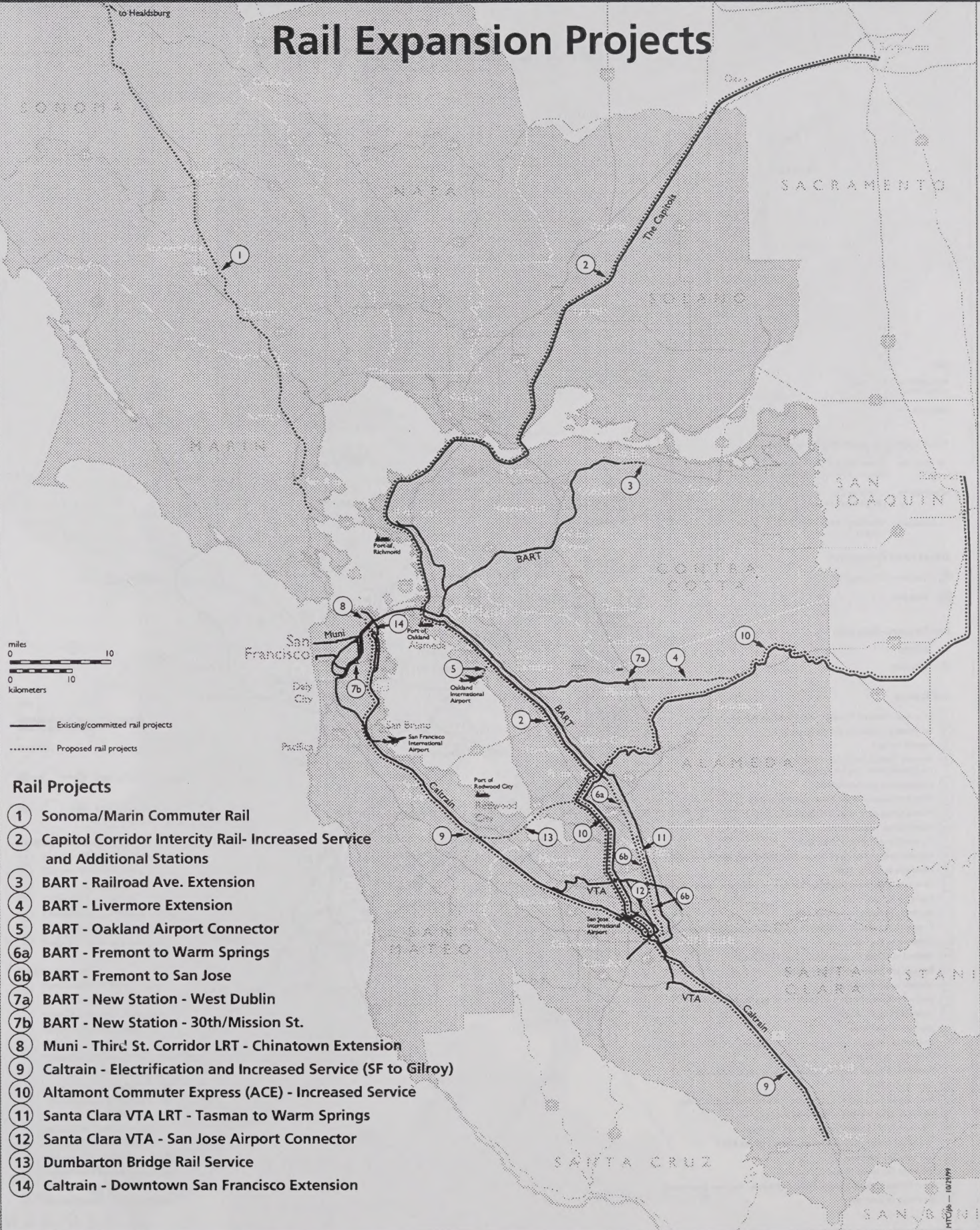


Figure 8

Bay Area Transportation Blueprint for the 21st Century

Rapid Bus Projects

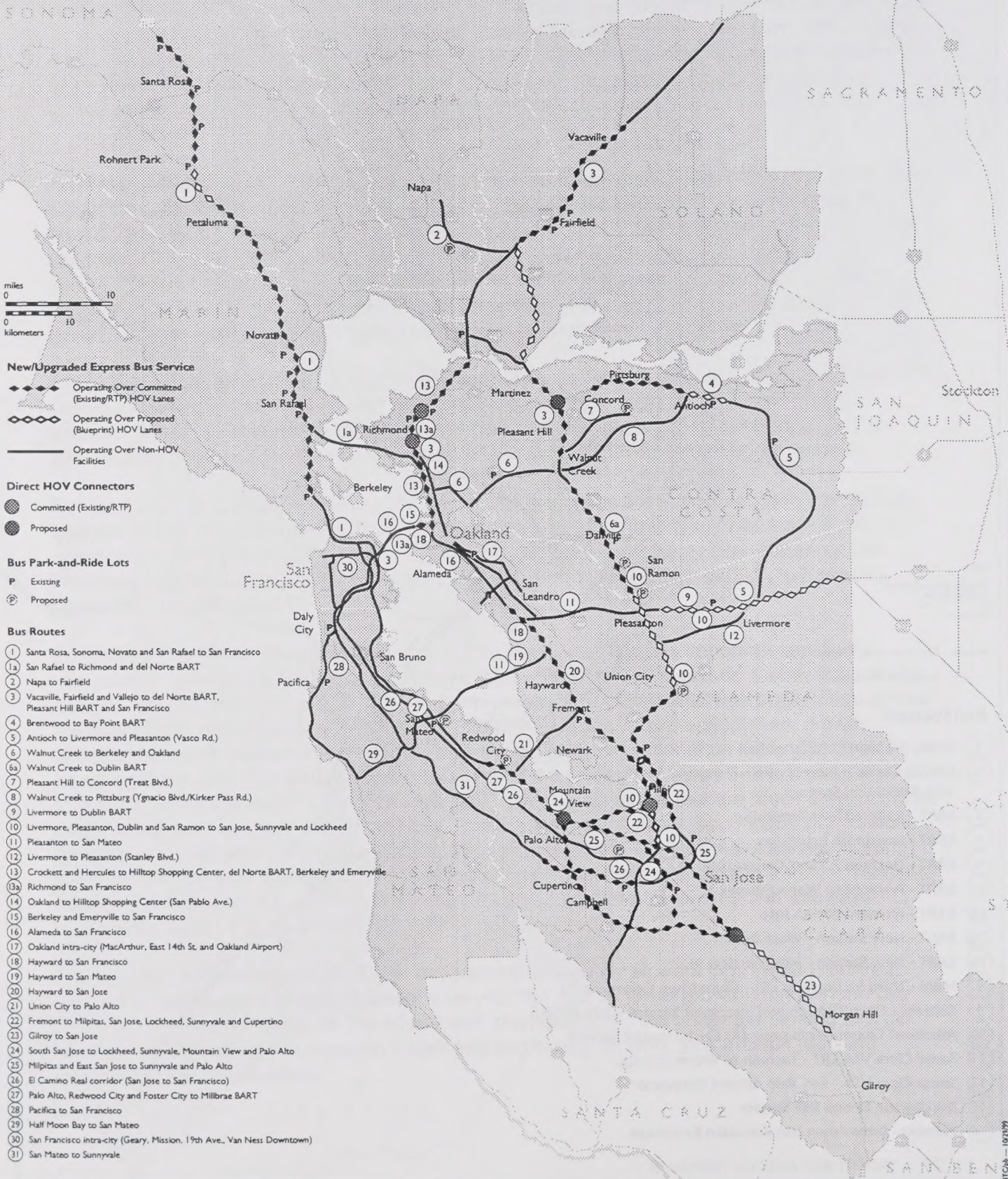


Figure 9

Bay Area Transportation Blueprint for the 21st Century

Ferry Expansion Projects

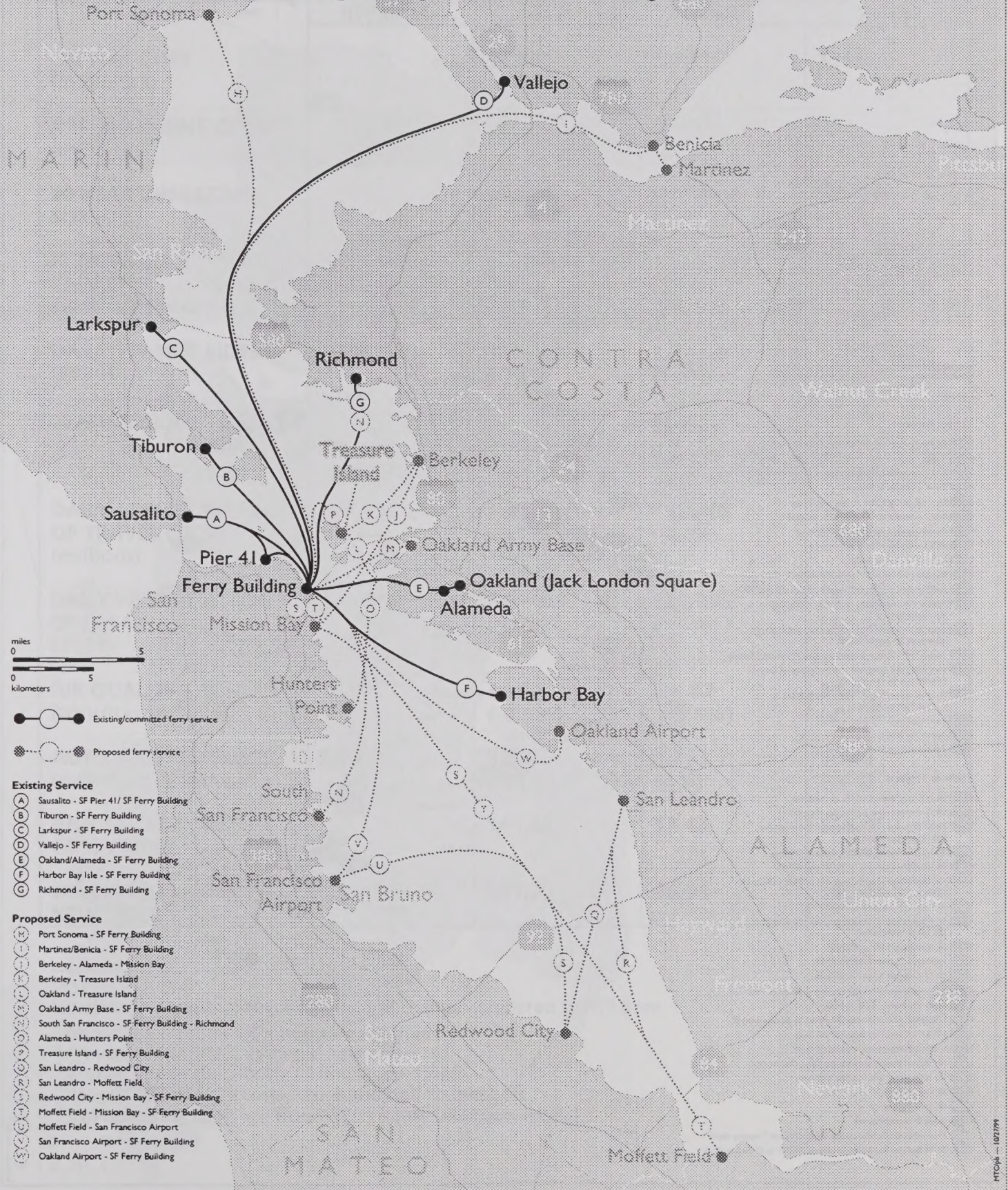


Figure 10

Bay Area Transportation Blueprint for the 21st Century

Additional Candidate Projects

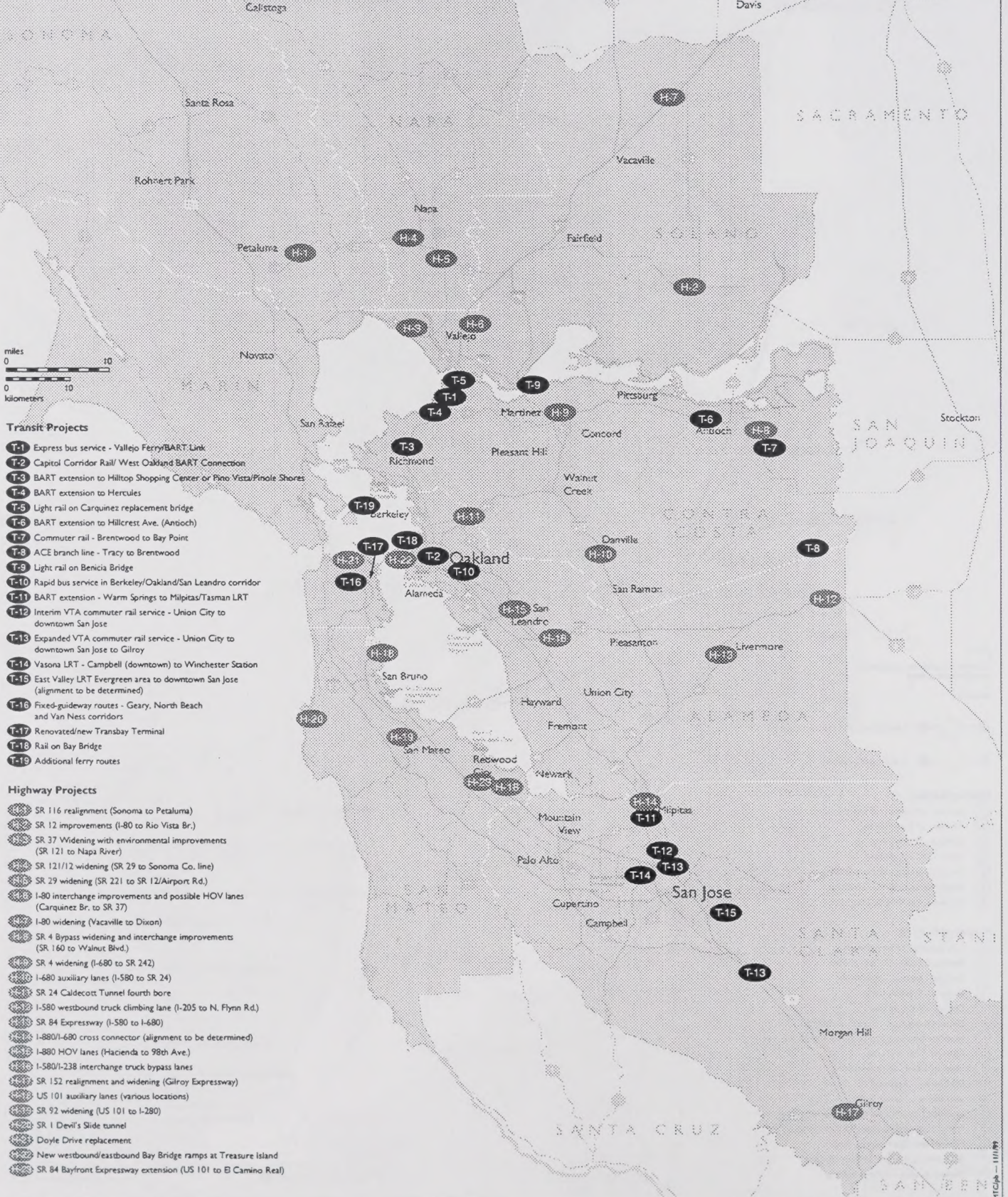


Figure 11

Comparison of Blueprint Packages

	RTP BASE	RAIL	BUS	FERRY
CAPITAL COST (millions \$)		\$8,550	\$745 ⁴	\$395
NET OPERATING COST ¹ (millions \$)		\$196 ⁵	\$146	\$88
20 YEAR OPERATING SUBSIDY		\$3,920	\$2,900	\$1,620
PEAK PERIOD TRANSIT CAPACITY (Seat miles/hour)	3,458,000	4,252,000 (23%)	4,002,000 (15.8%)	4,043,000 (16.9%)
DAILY TRANSIT RIDERS (2020)	1,608,900	1,661,800 (3.3%)	1,703,100 (5.9%)	1,615,300 (0.4%)
TRANSIT MODE SHARE -Work -Total	10.5% 6.2%	10.5% 6.4%	11.1% 6.6%	10.6% 6.3%
DAILY VEHICLE MILES OF TRAVEL (2020) (millions)	164,038	162,946 (-0.7%)	163,408 (-0.4%)	163,974 (Negligible)
DAILY VEHICLE HOURS OF DELAY (2020)	394,611	340,083 (-13.8%)	329,905 (-16.4%)	357,291 (-9.5%)
AIR QUALITY - ROG (tons/day in 2020)	35.03	34.81 (-0.6%)	34.82 (-0.6%)	34.96 (-0.2%)
AUTO FUEL CONSUMED (millions of gallons)	8,783	8,687 (-1.1%)	8,703 (-1%)	8,749 (-.4%)
ANNUALIZED CAPITAL COST / RIDER ²		\$41.43	\$2.45	\$16.41
OPERATING SUBSIDY / NEW RIDER ³		\$11.77	\$5.54	\$45.31

NOTES:

Numbers in parentheses are percentage change compared to RTP Base

¹ Annual operating cost minus fare revenues² Annualized capital \$ / Annual new riders³ Annual operating subsidy / Annual new riders⁴ Assigns half of HOV costs to bus and half to carpools⁵ Rail operating costs are from MTC Transit O&M cost model

Figure 12
RAIL, FERRY & BUS PACKAGES

RAIL PACKAGE

		Capital Cost (1999\$) (millions)	Net Operating Cost ¹ (1999\$) (millions)	20 Year Operating Subsidy
Corridor	Blueprint Candidate Project			
BART Extensions				
Fremont-South Bay	San Jose ²	\$4,053.00		
I-580	West Dublin Station	\$43.00		
I-580	Livermore	\$927.00		
San Francisco	SF 30th St/Mission BART Station	\$100.00		
SR 4	Pittsburg (Railroad Ave)	\$303.50		
	Subtotal	\$5,426.50		
Caltrain				
Peninsula	Caltrain Downtown Extension	\$701.10		
Peninsula	Grade Separations ³	\$304.00		
Peninsula	Caltrain Electrification	\$402.50		
Peninsula	Caltrain Rapid Rail Improvements	\$85.20		
Peninsula	Mass Transit Service	\$43.10		
Santa Clara Valley	Gilroy Service	\$51.50		
	Subtotal	\$1,587.40		
Capitol Corridor				
I-80	Capitol Corridor Upgrade	\$187.20		
	Subtotal	\$187.20		

Figure 12 (continued)

RAIL PACKAGE

Corridor	Blueprint Candidate Project	Capital Cost (1999\$) (millions)	Net Operating Cost ¹ (1999\$) (millions)	20 Year Operating Subsidy
Commuter Rail				
Golden Gate	NWP - Cloverdale/Healdsburg to San Rafael/Larkspur	\$189.80		
I-680 South	ACE Upgrade	\$81.89		
Transbay	Dumbarton Rail ⁴	\$150.00		
	Subtotal	\$421.69		
Other Rail				
I-880	Oakland Airport Rail Connector	\$134.00		
San Francisco	3rd Street LRT Extension to Chinatown	\$536.00		
Santa Clara Valley	San Jose Airport Transit Connector	\$257.50		
	Subtotal	\$927.50		
	TOTAL	\$8,550.29	\$196.00	\$3,920.00

Notes

¹Rail costs from MTC Transit O&M Cost Model

²Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) BART to San Jose Extension Study Update. The cost and ridership information are subject to change upon conclusion of this Study Update.

³Half the capital cost is allocated to Caltrain and half to autos.

⁴MTC defines this rail project as an augmentation of ACE service from Stockton to Millbrae in San Mateo County; whereas, the San Mateo Transportation Authority provides service from the Union City BART station to Millbrae and San Jose. The costs shown here represent the MTC project.

Figure 12 (continued)

FERRY PACKAGE

Corridor	Blueprint Candidate Project	Vessel Capital Cost (1999\$) (millions)	Facility Capital Cost (1999\$) (millions)	Total Capital Cost (1999\$) (millions)	Net Operating Cost (1999\$) (millions)	20 Year Operating Subsidy
MTC PLAN						
Golden Gate	Sausalito - San Francisco	\$4.23	\$0.00	\$4.23	\$0.04	\$0.80
Golden Gate	Port Sonoma - San Francisco	\$16.38	\$1.90	\$18.28	\$0.29	\$5.80
Golden Gate	Tiburon - San Francisco Ferry - Mission Bay	\$7.21	\$0.00	\$7.21	\$1.50	\$30.00
Golden Gate	Larkspur - San Francisco	\$24.72	\$25.00	\$49.72	\$5.10	\$102.00
I-80	Benicia - Martinez - San Francisco	\$18.00	\$4.20	\$22.20	\$0.50	\$10.06
I-80	Berkeley - San Francisco	\$10.00	\$5.50	\$15.50	\$0.91	\$18.18
I-80	Vallejo - San Francisco	\$8.75	\$17.00	\$25.75	\$1.71	\$34.14
Transbay	San Francisco Terminal	\$0.00	\$10.00	\$10.00	\$0.00	\$0.00
Transbay	Oakland - San Francisco	\$12.00	\$0.00	\$12.00	\$3.00	\$60.00
	Subtotal	\$101.29	\$63.60	\$164.89	\$13.05	\$260.98
BAY AREA COUNCIL PLAN						
Peninsula	SFO - Moffett Field	\$28.00		\$28.00	\$2.40	\$48.00
Peninsula	Redwood City - Mission Bay - SF Ferry	\$18.70		\$18.70	\$5.40	\$108.00
Peninsula	Moffett - Mssn Bay - San Francisco	\$24.70		\$24.70	\$8.00	\$160.00
Peninsula	SFO - San Francisco Ferry	\$21.00		\$21.00	\$11.40	\$228.00
Transbay	Richmond - SF - Mssn Bay - South SF	\$22.00		\$22.00	\$6.90	\$138.00
Transbay	Oakland Army Base - San Francisco Ferry	\$8.40		\$8.40	\$2.10	\$42.00
Transbay	Berkeley - Treasure Island	\$7.00		\$7.00	\$2.20	\$44.00
Transbay	Oak - Treasure Island	\$7.00		\$7.00	\$2.20	\$44.00
Transbay	SF Ferry Terminal - Treasure Island	\$9.00		\$9.00	\$2.80	\$56.00
Transbay	Oak Airport - San Francisco Ferry	\$21.00		\$21.00	\$3.30	\$66.00
Transbay	Alameda - Hunters Point	\$14.10		\$14.10	\$6.70	\$134.00
Transbay	Harbor Bay - San Francisco Ferry	\$15.00		\$15.00	\$6.70	\$134.00
Transbay	San Leandro - Moffett Field	\$19.40		\$19.40	\$7.20	\$144.00
Transbay	San Leandro - Redwood City	\$14.70		\$14.70	\$7.80	\$156.00
	Subtotal	\$230.00	\$0.00	\$230.00	\$75.10	\$1,502.00
	TOTAL	\$331.29	\$63.60	\$394.89	\$88.15	\$1,762.98

Figure 12 (continued)

BUS PACKAGE

Corridor	Blueprint Candidate Project	Bus Capital Cost (1999\$) (millions)	HOV Capital Cost ¹ (1999\$) (millions)	Total Capital Cost (1999\$) (millions)	Net Operating Cost (1999\$) (millions)	20 Year Operating Subsidy
Fremont-South Bay	San Joaquin Co., Tri-Valley, Hayward, Fremont to Santa Clara Co.	\$20.00		\$20.00	\$12.00	\$240.00
Golden Gate	Golden Gate HOV		\$49.00	\$49.00		
Golden Gate	Intra Marin County	\$2.46		\$2.46	\$3.48	\$69.60
Golden Gate	Sonoma/Marin to San Francisco	\$12.67		\$12.67	\$12.86	\$257.20
Golden Gate	Marin to Contra Costa	\$2.11		\$2.11	\$3.30	\$66.00
Golden Gate	Intra Sonoma County	\$4.58		\$4.58	\$2.06	\$41.20
I-580	I-580 HOV		\$61.80	\$61.80		
I-580	Intra-Tri-Valley	\$1.76		\$1.76	\$1.63	\$32.60
I-580	San Joaquin to Tri-Valley, Dub/Pleas BART	\$2.00		\$2.00	\$1.50	\$30.00
I-580	Tri-Valley to Cent San Mateo/Ala	\$6.34		\$6.34	\$2.53	\$50.60
I-680 North	I-680 North HOV		\$57.50	\$57.50		
I-680 North	Intra- Central Contra Costa	\$5.98		\$5.98	\$3.03	\$60.60
I-680 North	Solano to East Bay (I-680)	\$2.11		\$2.11	\$0.78	\$15.60
I-680 North	Cent CC- North Oak/Berkeley	\$4.22		\$4.22	\$1.22	\$24.40
I-680 South	I-680 South HOV		\$26.80	\$26.80		
I-680 South	Tri-Valley to Silicon Valley	\$14.78		\$14.78	\$6.61	\$132.20
I-80	Intra West CC	\$0.70		\$0.70	\$0.36	\$7.20
I-80	Intra-Solano County	\$1.06		\$1.06	\$1.07	\$21.40
I-80	West CC to Oak-Berk	\$8.10		\$8.10	\$8.90	\$178.00
I-80	Solano to San Francisco - New	\$4.22		\$4.22	\$1.03	\$20.60
I-80	West CC to SF	\$2.11		\$2.11	\$1.37	\$27.40
I-80	Solano to East Bay (I-80)	\$4.22		\$4.22	\$1.33	\$26.60

Figure 12 (continued)

BUS PACKAGE

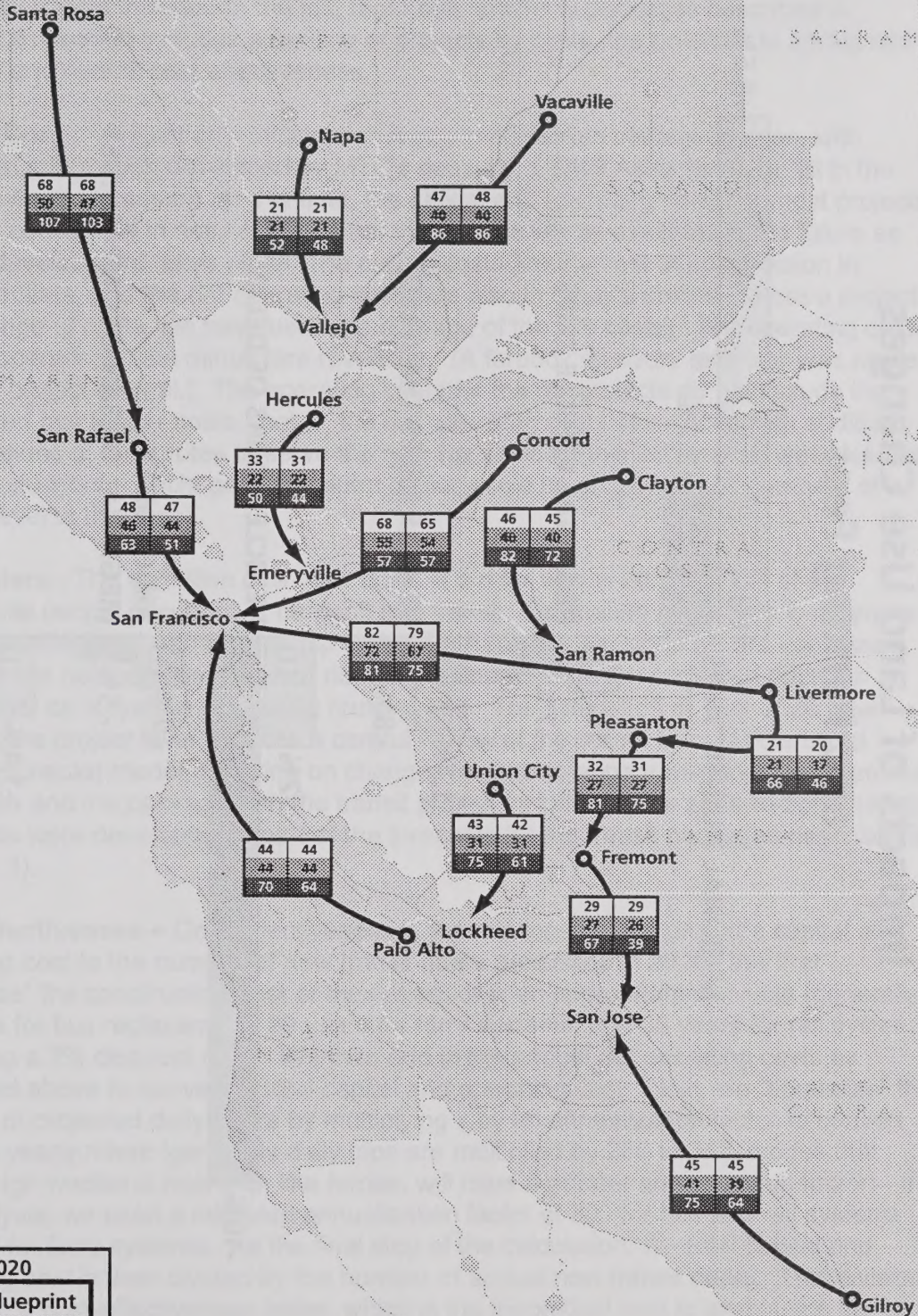
Corridor	Blueprint Candidate Project	Bus Capital Cost (1999\$) (millions)	HOV Capital Cost ¹ (1999\$) (millions)	Total Capital Cost (1999\$) (millions)	Net Operating Cost (1999\$) (millions)	20 Year Operating Subsidy
I-880	I-880 HOV		\$210.00	\$210.00		
I-880	South Alameda to Silicon Valley	\$2.50		\$2.50	\$6.80	\$136.00
I-880	Hayward-San Leandro to Silicon Valley	\$8.72		\$8.72	\$4.80	\$96.00
I-880	Intra Oakland-Berkeley	\$7.39		\$7.39	\$4.33	\$86.60
I-880	Hayward-San Leandro to Oak/Berk	\$6.34		\$6.34	\$5.81	\$116.20
North Bay-East-West	Napa to Solano	\$1.41		\$1.41	\$0.36	\$7.20
Peninsula	Intra-San Mateo	\$8.80		\$8.80	\$6.94	\$138.80
Peninsula	South/Central/North SM to SF	\$14.08		\$14.08	\$7.53	\$150.60
Peninsula	So/Cen San Mateo to Colma BART/Silicon Valley	\$13.28		\$13.28	\$3.92	\$78.40
San Francisco	Richmond District	\$5.98		\$5.98	\$6.43	\$128.60
San Francisco	Mission/Bay View	\$10.21		\$10.21	\$8.09	\$161.80
San Francisco	Sunset	\$5.98		\$5.98	\$5.44	\$108.80
Santa Clara Valley	Santa Clara Valley HOV		\$74.50	\$74.50		
Santa Clara Valley	Intra-Santa Clara County	\$19.01		\$19.01	\$13.59	\$271.80
SR-4	SR 4 HOV		\$50.00	\$50.00		
SR-4	East Contra Costa to BART	\$1.06		\$1.06	\$1.12	\$22.40
SR-4	East Contra Costa to Tri-Valley	\$4.22		\$4.22	\$1.70	\$34.00
Transbay	South/Cent Ala to SF	\$3.17		\$3.17	\$1.56	\$31.20
Transbay	East Bay to Cent. San Mateo	\$3.87		\$3.87	\$2.31	\$46.20
TOTAL		\$215.44	\$529.60	\$745.04	\$145.79	\$2,915.80

Note

¹Rapid bus package assigns half of HOV construction costs to buses and half to carpools

Figure 13

Selected City-to-City Travel Times by Mode and Alternative (2020)

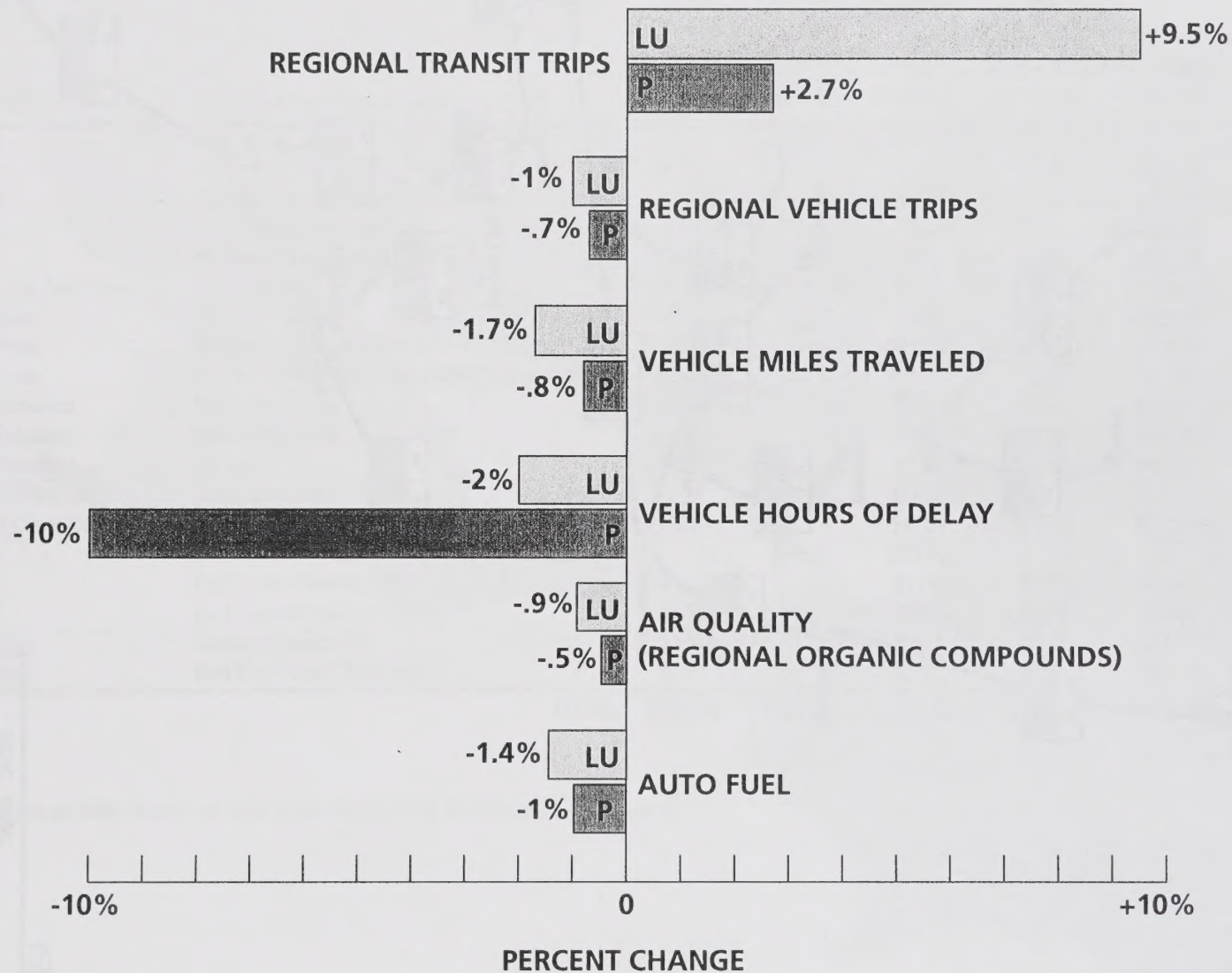


KEY

	2020 RTP	2020 Blueprint
Drive Alone	RTP	Blueprint
Car Pool	RTP	Blueprint
Transit	RTP	Blueprint
Travel Time (Minutes)		

Figure 14

Impacts of Land Use Changes and Parking Fees



CHAPTER 4

EVALUATION OF MAJOR TRANSIT PROJECTS

As requested in the fall 1999 public outreach meetings, MTC has developed information on individual transit projects included in the rail, rapid bus, and ferry packages described in Chapter 3. The evaluation includes a ranking of projects by costs, the potential to attract new riders to transit, and overall cost effectiveness.

Project Costs - Project cost information was provided from various sources, with additional information developed by MTC's consultant, DKS Associates, to "fill in the blanks" where necessary. At this time, the capital and operating costs for most projects are very conceptual in nature, and better information will be available in the future as project development takes place. The capital costs are the cost of construction in today's dollars, and the net operating costs are also in today's dollars (where a project has a range of costs, we have used the average of the two costs). Net operating costs are the operating costs minus fare revenues. (A farebox recovery estimate was made for each project as well.) The operating costs for the rail projects do not include the associated bus feeder costs, that is, the net operating costs associated with additions and deletions of bus routes to serve the new rail stations (this information was included in the evaluation of packages in Chapter 3, but would be difficult to disaggregate at a project level at this time).

New Riders - The definition of a "new rider" is a rider who is attracted out of an automobile (single occupant or carpool) into transit. Estimating new riders is different than estimating total transit ridership (shown in Appendix A), since we are concerned only with the net increase in transit ridership as opposed to the projected ridership (boardings) on a system or specific route or line. The estimation of year 2020 new riders at the project level requires a careful review of the output from MTC's travel demand forecast model, focusing on changes in zone-to-zone transit trips between the RTP base and the package with the transit project included. (The zone-to-zone transit trip tables were developed as part of the forecasts for the transit packages described in Chapter 3).

Cost Effectiveness - Cost-effectiveness is the relationship of a project's capital and operating cost to the number of new transit riders generated in 2020. We first "capitalize" the construction cost of the project over an appropriate life cycle (generally 12 years for bus replacement, 20 years for ferry systems, and 30 years for rail systems, assuming a 7% discount rate). We then add in the annual net operating costs as described above to derive the total capital and operating cost. Next, we "annualize" the number of projected daily riders by multiplying it by an annualization factor to convert these to yearly riders (generally daily trips are multiplied by 280 to 340; modes that exhibit high weekend ridership, like ferries, will have a greater annualization factor). In our analysis, we used a ridership annualization factor of 300 for bus and rail systems and 340 for ferry systems. As the final step of the calculation, the total capital and operating cost is then divided by the number of annual new transit riders. This division results in a cost-effectiveness index, which is the theoretical cost to attract one trip to transit.

This information is presented in a series of figures shown below.

- Figure 15 ranks projects by new riders generated.
- Figure 16 ranks projects by their annualized capital cost and annual net operating cost.
- Figure 17 ranks projects by cost per new rider.
- Figure 18 sorts and ranks project by cost effectiveness by corridor.

Figure 15
Ranking of Blueprint Projects by New Daily Transit Riders
(high to low)

Blueprint Project	Type	Corridor	New Riders (Daily)
1 Caltrain Electrification, Mass Transit Svc, Downtown Ext., Grade Separations	Rail	Peninsula	20,000
2 Caltrain Electrification, Mass Transit Service, & Grade Separations Only	Rail	Peninsula	16,000
3 Caltrain Mass Transit Service & Grade Separations Only	Rail	Peninsula	14,000
4 Intra-Santa Clara County Rapid Bus	Bus	Santa Clara Valley	12,000
5 BART to San Jose (1)	Rail	Fremont-South Bay	11,500
6 BART to Livermore + Dublin infill (3 station)	Rail	I-580	9,800
7 Mission/Bay View Muni Bus	Bus	San Francisco	8,800
8 Intra Oakland-Berkeley Rapid Bus	Bus	I-880	8,500
9 VTA Tasman LRT to Fremont BART	Rail	Fremont-South Bay	8,500
10 BART to Warm Springs and VTA LRT to Warm Springs	Rail	Fremont-South Bay	8,500
11 Intra-San Mateo Co. Rapid Bus	Bus	Peninsula	8,300
12 South/Central/North San Mateo to San Francisco Rapid Bus	Bus	Peninsula	8,200
13 Intra Marin County Rapid Bus	Bus	Golden Gate	6,300
14 Sonoma/Marin to San Francisco Rapid Bus	Bus	Golden Gate	5,800
15 Richmond District Muni Bus	Bus	San Francisco	5,300
16 3rd Street LRT Extension to Chinatown	Rail	San Francisco	5,100
17 San Joaquin Co., Tri-Valley, Hayward, Fremont to Santa Clara Co. Rapid Bus	Bus	Fremont-South Bay	5,000
18 Expanded Interim VTA Commuter Rail Service	Rail	Fremont-South Bay	4,600
19 Sonoma/Marin Commuter Rail (NWP)	Rail	Golden Gate	4,000
20 ACE Upgrade	Rail	I-680 South	3,400
21 Downtown San Jose/East Valley Bus Rapid Transit on Monterey Highway (Diridon Station to Santa Teresa LRT Station)(2)	Bus	Santa Clara Valley	3,200
22 Oakland Airport Rail Connector	Rail	I-880	3,100
23 South/Central San Mateo to Colma BART/Silicon Valley Rapid Bus	Bus	Peninsula	3,000
24 Intra-Tri-Valley Rapid Bus	Bus	I-580	2,800
25 Downtown San Jose/East Valley LRT along Santa Clara St/Alum Rock Ave (Diridon Station to Capitol LRT Line)(2)	Rail	Santa Clara Valley	2,800
26 Capitol Corridor Upgrade	Rail	I-80	2,400
27 South Alameda to Silicon Valley Rapid Bus	Bus	I-880	2,300

(continued)

Figure 15
Ranking of Blueprint Projects by New Daily Transit Riders
(high to low)

	Blueprint Project	Type	Corridor	New Riders (Daily)
28	Downtown San Jose/East Valley LRT on Capitol Expressway (Capitol LRT Line to Eastridge Mall)(2)	Rail	Santa Clara Valley	2,300
29	West Contra Costa Co. to Oakland/Berkeley Rapid Bus	Bus	I-80	2,100
30	Intra West Contra Costa Co. Rapid Bus	Bus	I-80	2,000
31	South/Central Alameda to San Francisco Rapid Bus	Bus	Transbay	2,000
32	Richmond - San Francisco - Mission Bay - South San Francisco Ferry	Ferry	Transbay	2,000
33	BART to Pittsburg (1 station)	Rail	SR-4	1,800
34	Hayward-San Leandro to Oakland/Berkeley Rapid Bus	Bus	I-880	1,600
35	Intra-Central Contra Costa Rapid Bus	Bus	I-680 North	1,500
36	Hayward-San Leandro to Silicon Valley Rapid Bus	Bus	I-880	1,500
37	Downtown San Jose/East Valley LRT on Capitol Expressway (Eastridge Mall to Guadalupe LRT Line) (2)	Rail	Santa Clara Valley	1,500
38	San Joaquin to Tri-Valley, Dublin/Pleasanton BART Rapid Bus	Bus	I-580	1,400
39	Larkspur - San Francisco Ferry	Ferry	Golden Gate	1,400
40	Intra-Solano County Rapid Bus	Bus	I-80	1,200
41	Sunset Muni Bus	Bus	San Francisco	1,200
42	San Jose Airport Rail Connector	Rail	Santa Clara Valley	1,100
43	Dumbarton Rail (MTC Alignment)	Rail	Transbay	1,100
44	Tri-Valley to Silicon Valley Rapid Bus	Bus	I-680 South	1,000
45	East Bay to Central San Mateo Co. Rapid Bus	Bus	Transbay	1,000
46	East Contra Costa to BART Rapid Bus	Bus	SR-4	900
47	Central Contra Costa to North Oakland/Berkeley Rapid Bus	Bus	I-680 North	500
48	Vallejo - San Francisco Ferry	Ferry	Transbay	500
49	Intra Sonoma County Rapid Bus	Bus	Golden Gate	400
50	Solano to San Francisco Rapid Bus	Bus	I-80	400
51	East Contra Costa to Tri-Valley Rapid Bus	Bus	SR-4	400
52	Sausalito - San Francisco Ferry	Ferry	Golden Gate	400
53	Marin to Contra Costa Rapid Bus	Bus	Golden Gate	300

(continued)

Figure 15
Ranking of Blueprint Projects by New Daily Transit Riders
(high to low)

Blueprint Project	Type	Corridor	New Riders (Daily)
54 Tri-Valley to Central San Mateo/Alameda Co. Rapid Bus	Bus	I-580	300
55 Solano to East Bay (I-680) Rapid Bus	Bus	I-680 North	300
56 Tiburon - San Francisco - Mission Bay Ferry	Ferry	Golden Gate	300
57 West Contra Costa Co. to San Francisco Rapid Bus	Bus	I-80	200
58 Solano Co. to East Bay (I-80) Rapid Bus	Bus	I-80	200
59 Napa Co. to Solano Co. Rapid Bus	Bus	North Bay-East-West	200
60 SFO - San Francisco Ferry	Ferry	Peninsula	200
61 Moffett - Mission Bay - San Francisco Ferry	Ferry	Peninsula	200
62 Oakland Airport - San Francisco Ferry	Ferry	Transbay	200
63 SFO - Moffett Field Ferry	Ferry	Peninsula	100
64 San Leandro - Redwood City Ferry	Ferry	Transbay	100
65 BART infill @ 30th/Mission (1 station)	Rail	San Francisco	100
66 Port Sonoma - San Francisco Ferry	Ferry	Golden Gate	50
67 Benicia - Martinez - San Francisco Ferry	Ferry	I-80	50
68 Redwood City - Mission Bay - San Francisco Ferry	Ferry	Peninsula	50
69 Oakland - Treasure Island Ferry	Ferry	Transbay	50
70 Berkeley - Treasure Island Ferry	Ferry	Transbay	50
71 Alameda - Hunters Point Ferry	Ferry	Transbay	50
72 Oakland Army Base- San Francisco Ferry	Ferry	Transbay	50
73 Harbor Bay - San Francisco Ferry	Ferry	Transbay	50
74 Oakland - Alameda - San Francisco Ferry	Ferry	Transbay	50
75 San Leandro - Moffett Field Ferry	Ferry	Transbay	50
76 Berkeley - San Francisco Ferry- Mission Bay Alameda Ferry	Ferry	Transbay	50

Notes

(1) Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) *BART to San Jose Extension Study Update*. The cost and ridership information are subject to change upon conclusion of this Study Update.

(2) Information provided by project sponsor (VTA) and not evaluated as part of the larger Blueprint package of rail projects.

Figure 16

**Ranking of Blueprint Projects by Total Annualized Capital & Net Operating Costs
(low cost to high cost)**

Blueprint Project	Type	Corridor	Net Annual Operating Cost (1999\$) (millions)	Annualized Capital (millions)	Total Annualized Capital & Net Operating Costs (millions)
1 Sausalito - San Francisco Ferry	Ferry	Golden Gate	\$0.04	\$0.40	\$0.44
2 Intra West Contra Costa Co. Rapid Bus	Bus	I-80	\$0.36	\$0.09	\$0.45
3 Napa Co. to Solano Co. Rapid Bus	Bus	North Bay-East-West	\$0.36	\$0.18	\$0.54
4 Solano to East Bay (I-680) Rapid Bus	Bus	I-680 North	\$0.78	\$0.27	\$1.05
5 Intra-Solano County Rapid Bus	Bus	I-80	\$1.07	\$0.13	\$1.20
6 East Contra Costa to BART Rapid Bus	Bus	SR-4	\$1.12	\$0.13	\$1.25
7 Solano to San Francisco Rapid Bus	Bus	I-80	\$1.03	\$0.53	\$1.56
8 West Contra Costa Co. to San Francisco Rapid Bus	Bus	I-80	\$1.37	\$0.27	\$1.64
9 San Joaquin to Tri-Valley, Dublin/Pleasanton BART Rapid Bus	Bus	I-580	\$1.50	\$0.25	\$1.75
10 Central Contra Costa to North Oakland/Berkeley Rapid Bus	Bus	I-680 North	\$1.22	\$0.53	\$1.75
11 Port Sonoma - San Francisco Ferry	Ferry	Golden Gate	\$0.29	\$1.54	\$1.83
12 Intra-Tri-Valley Rapid Bus	Bus	I-580	\$1.63	\$0.22	\$1.85
13 Solano Co. to East Bay (I-80) Rapid Bus	Bus	I-80	\$1.33	\$0.53	\$1.86
14 South/Central Alameda to San Francisco Rapid Bus	Bus	Transbay	\$1.56	\$0.40	\$1.96
15 Tiburon - San Francisco - Mission Bay Ferry	Ferry	Golden Gate	\$1.50	\$0.68	\$2.18
16 East Contra Costa to Tri-Valley Rapid Bus	Bus	SR-4	\$1.70	\$0.53	\$2.23
17 Benicia - Martinez - San Francisco Ferry	Ferry	I-80	\$0.50	\$2.09	\$2.59
18 Intra Sonoma County Rapid Bus	Bus	Golden Gate	\$2.06	\$0.58	\$2.64
19 East Bay to Central San Mateo Co. Rapid Bus	Bus	Transbay	\$2.31	\$0.49	\$2.80
20 Oakland - Treasure Island Ferry	Ferry	Transbay	\$2.20	\$0.66	\$2.86
21 Berkeley - Treasure Island Ferry	Ferry	Transbay	\$2.20	\$0.66	\$2.86
22 Oakland Army Base- San Francisco Ferry	Ferry	Transbay	\$2.10	\$0.79	\$2.89
23 Tri-Valley to Central San Mateo/Alameda Co. Rapid Bus	Bus	I-580	\$2.53	\$0.80	\$3.33
24 Marin to Contra Costa Rapid Bus	Bus	Golden Gate	\$3.30	\$0.27	\$3.57
25 Downtown San Jose/East Valley Bus Rapid Transit on Monterey Highway (Diridon Station to Santa Teresa LRT Station)(2)	Bus	Santa Clara Valley	\$1.40	\$2.37	\$3.77
26 Intra-Central Contra Costa Rapid Bus	Bus	I-680 North	\$3.03	\$0.75	\$3.78
27 Intra Marin County Rapid Bus	Bus	Golden Gate	\$3.48	\$0.31	\$3.79
28 SFO - Moffett Field Ferry	Ferry	Peninsula	\$2.40	\$2.63	\$5.03
29 Intra Oakland-Berkeley Rapid Bus	Bus	I-880	\$4.33	\$0.93	\$5.26
30 Oakland Airport - San Francisco Ferry	Ferry	Transbay	\$3.30	\$1.97	\$5.27

(continued)

Figure 16

Ranking of Blueprint Projects by Total Annualized Capital & Net Operating Costs
(low cost to high cost)

	Blueprint Project	Type	Corridor	Net Annual Operating Cost (1999\$) (millions)	Annualized Capital (millions)	Total Annualized Capital & Net Operating Costs (millions)
31	South/Central San Mateo to Colma BART/Silicon Valley Rapid Bus	Bus	Peninsula	\$3.92	\$1.67	\$5.59
32	Hayward-San Leandro to Silicon Valley Rapid Bus	Bus	I-880	\$4.80	\$1.10	\$5.90
33	Sunset Muni Bus	Bus	San Francisco	\$5.44	\$0.75	\$6.19
34	Hayward-San Leandro to Oakland/Berkeley Rapid Bus	Bus	I-880	\$5.81	\$0.80	\$6.61
35	South Alameda to Silicon Valley Rapid Bus	Bus	I-880	\$6.80	\$0.31	\$7.11
36	Redwood City - Mission Bay - San Francisco Ferry	Ferry	Peninsula	\$5.40	\$1.76	\$7.16
37	Richmond District Muni Bus	Bus	San Francisco	\$6.43	\$0.75	\$7.18
38	Alameda - Hunters Point Ferry	Ferry	Transbay	\$6.70	\$1.33	\$8.03
39	Intra-San Mateo Co. Rapid Bus	Bus	Peninsula	\$6.94	\$1.11	\$8.05
40	BART infill @ 30th/Mission (1 station)	Rail	San Francisco	\$0.00	\$8.10	\$8.10
41	Harbor Bay - San Francisco Ferry	Ferry	Transbay	\$6.70	\$1.41	\$8.11
42	Oakland - Alameda - San Francisco Ferry	Ferry	Transbay	\$6.80	\$1.45	\$8.25
43	Tri-Valley to Silicon Valley Rapid Bus	Bus	I-680 South	\$6.61	\$1.86	\$8.47
44	Richmond - San Francisco - Mission Bay - South San Francisco Ferry	Ferry	Transbay	\$6.90	\$2.07	\$8.97
45	San Leandro - Moffett Field Ferry	Ferry	Transbay	\$7.20	\$1.82	\$9.02
46	San Leandro - Redwood City Ferry	Ferry	Transbay	\$7.80	\$1.38	\$9.18
47	South/Central/North San Mateo to San Francisco Rapid Bus	Bus	Peninsula	\$7.53	\$1.77	\$9.30
48	Mission/Bay View Muni Bus	Bus	San Francisco	\$8.09	\$1.29	\$9.38
49	Larkspur - San Francisco Ferry	Ferry	Golden Gate	\$5.10	\$4.67	\$9.77
50	West Contra Costa Co. to Oakland/Berkeley Rapid Bus	Bus	I-80	\$8.90	\$1.02	\$9.92
51	Moffett - Mission Bay - San Francisco Ferry	Ferry	Peninsula	\$8.00	\$2.32	\$10.32
52	Berkeley - San Francisco Ferry- Mission Bay - Alameda Ferry	Ferry	Transbay	\$8.40	\$2.11	\$10.51
53	Oakland Airport Rail Connector	Rail	I-880	\$0.39	\$10.85	\$11.24
54	ACE Upgrade	Rail	I-680 South	\$4.86	\$6.63	\$11.49
55	SFO - San Francisco Ferry	Ferry	Peninsula	\$11.40	\$1.97	\$13.37
56	Sonoma/Marin to San Francisco Rapid Bus	Bus	Golden Gate	\$12.86	\$1.60	\$14.46
57	San Joaquin Co., Tri-Valley, Hayward, Fremont to Santa Clara Co. Rapid Bus	Bus	Fremont-South Bay	\$12.00	\$2.52	\$14.52
58	Intra-Santa Clara County Rapid Bus	Bus	Santa Clara Valley	\$13.59	\$2.40	\$15.99
59	Dumbarton Rail (MTC Alignment)	Rail	Transbay	\$4.00	\$12.15	\$16.15
60	Vallejo - San Francisco Ferry	Ferry	Transbay	\$11.00	\$6.79	\$17.79

(continued)

Figure 16

Ranking of Blueprint Projects by Total Annualized Capital & Net Operating Costs
(low cost to high cost)

Blueprint Project	Type	Corridor	Net Annual Operating Cost (1999\$) (millions)	Annualized Capital (millions)	Total Annualized Capital & Net Operating Costs (millions)
61 Downtown San Jose/East Valley LRT on Capitol Expressway (Capitol LRT Line to Eastridge Mall)(2)	Rail	Santa Clara Valley	\$1.90	\$17.03	\$18.93
62 Downtown San Jose/East Valley LRT along Santa Clara St/Alum Rock Ave (Diridon Station to Capitol LRT Line)(2)	Rail	Santa Clara Valley	\$1.50	\$19.64	\$21.14
63 San Jose Airport Rail Connector	Rail	Santa Clara Valley	\$0.70	\$20.86	\$21.56
64 Sonoma/Marin Commuter Rail (NWP)	Rail	Golden Gate	\$8.66	\$15.37	\$24.03
65 Downtown San Jose/East Valley LRT on Capitol Expressway (Eastridge Mall to Guadalupe LRT Line) (2)	Rail	Santa Clara Valley	\$2.70	\$21.39	\$24.09
66 BART to Pittsburg (1 station)	Rail	SR-4	\$0.07	\$24.58	\$24.65
67 Capitol Corridor Upgrade	Rail	I-80	\$9.60	\$15.16	\$24.76
68 3rd Street LRT Extension to Chinatown	Rail	San Francisco	\$2.30	\$43.42	\$45.72
69 Expanded Interim VTA Commuter Rail Service	Rail	Fremont-South Bay	\$9.90	\$38.07	\$47.97
70 VTA Tasman LRT to Fremont BART	Rail	Fremont-South Bay	\$14.46	\$40.50	\$54.96
71 Caltrain Mass Transit Service & Grade Separations Only	Rail	Peninsula	\$32.10	\$28.12	\$60.22
72 BART to Livermore + Dublin infill (3 station)	Rail	I-580	\$0.87	\$75.09	\$75.95
73 BART to Warm Springs and VTA LRT to Warm Springs	Rail	Fremont-South Bay	\$17.29	\$70.49	\$87.78
74 Caltrain Electrification, Mass Transit Service, & Grade Separations Only	Rail	Peninsula	\$39.50	\$60.72	\$100.22
75 Caltrain Electrification, Mass Transit Svc, Downtown Ext., Grade Separations	Rail	Peninsula	\$39.50	\$117.51	\$157.01
76 BART to San Jose (1)	Rail	Fremont-South Bay	\$18.40	\$328.29	\$346.69

Notes

(1) Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) *BART to San Jose Extension Study Update*. The cost and ridership information are subject to change upon conclusion of this Study Update.

(2) Information provided by project sponsor (VTA) and not evaluated as part of the larger Blueprint package of rail projects.

Figure 17

Ranking of Blueprint Projects by Cost Per New Rider
(low cost to high cost)

Blueprint Project			Total Annualized Capital & Net Operating Costs (millions)	New Riders (Annualized) (millions)	Cost / New Rider
Blueprint Project	Type	Corridor			
1 Intra West Contra Costa Co. Rapid Bus	Bus	I-80	\$0.45	0.6	\$0.75
2 Intra Marin County Rapid Bus	Bus	Golden Gate	\$3.79	1.89	\$2.01
3 Intra Oakland-Berkeley Rapid Bus	Bus	I-880	\$5.26	2.55	\$2.06
4 Intra-Tri-Valley Rapid Bus	Bus	I-580	\$1.85	0.84	\$2.20
5 Sausalito - San Francisco Ferry	Ferry	Golden Gate	\$0.44	0.136	\$3.21
6 Intra-San Mateo Co. Rapid Bus	Bus	Peninsula	\$8.05	2.49	\$3.23
7 South/Central Alameda to San Francisco Rapid Bus	Bus	Transbay	\$1.96	0.6	\$3.27
8 Intra-Solano County Rapid Bus	Bus	I-80	\$1.20	0.36	\$3.34
9 Mission/Bay View Muni Bus	Bus	San Francisco	\$9.38	2.64	\$3.55
10 Intra-Santa Clara County Rapid Bus	Bus	Santa Clara Valley	\$15.99	4.5	\$3.55
11 South/Central/North San Mateo to San Francisco Rapid Bus	Bus	Peninsula	\$9.30	2.46	\$3.78
12 Downtown San Jose/East Valley Bus Rapid Transit on Monterey Highway (Diridon Station to Santa Teresa LRT Station)(2)	Bus	Santa Clara Valley	\$3.77	0.96	\$3.93
13 San Joaquin to Tri-Valley, Dublin/Pleasanton BART Rapid Bus	Bus	I-580	\$1.75	0.42	\$4.17
14 Richmond District Muni Bus	Bus	San Francisco	\$7.18	1.59	\$4.52
15 East Contra Costa to BART Rapid Bus	Bus	SR-4	\$1.25	0.27	\$4.64
16 BART/Silicon Valley Rapid Bus	Bus	Peninsula	\$5.59	0.9	\$6.21
17 Sonoma/Marin to San Francisco Rapid Bus	Bus	Golden Gate	\$14.46	1.74	\$8.31
18 Intra-Central Contra Costa Rapid Bus	Bus	I-680 North	\$3.78	0.45	\$8.41
19 Napa Co. to Solano Co. Rapid Bus	Bus	North Bay-East-West	\$0.54	0.06	\$8.96
20 East Bay to Central San Mateo Co. Rapid Bus	Bus	Transbay	\$2.80	0.3	\$9.33
21 San Joaquin Co., Tri-Valley, Hayward, Fremont to Santa Clara Co. Rapid Bus	Bus	Fremont-South Bay	\$14.52	1.5	\$9.68
22 South Alameda to Silicon Valley Rapid Bus	Bus	I-880	\$7.11	0.69	\$10.31
23 ACE Upgrade	Rail	I-680 South	\$11.49	1.02	\$11.27
24 Solano to East Bay (I-680) Rapid Bus	Bus	I-680 North	\$1.05	0.09	\$11.62
25 Central Contra Costa to North Oakland/Berkeley Rapid Bus	Bus	I-680 North	\$1.75	0.15	\$11.68
26 Oakland Airport Rail Connector	Rail	I-880	\$11.24	0.93	\$12.09
27 Solano to San Francisco Rapid Bus	Bus	I-80	\$1.56	0.12	\$13.02
28 Hayward-San Leandro to Silicon Valley Rapid Bus	Bus	I-880	\$5.90	0.45	\$13.11
29 Richmond - San Francisco - Mission Bay - South San Francisco Ferry	Ferry	Transbay	\$8.97	0.68	\$13.19
30 Hayward-San Leandro to Oakland/Berkeley Rapid Bus	Bus	I-880	\$6.61	0.48	\$13.77

(continued)

Figure 17

Ranking of Blueprint Projects by Cost Per New Rider
(low cost to high cost)

Blueprint Project	Type	Corridor	Total Annualized Capital & Net Operating Costs (millions)	New Riders (Annualized) (millions)	Cost / New Rider
31 Caltrain Mass Transit Service & Grade Separations Only	Rail	Peninsula	\$60.22	4.2	\$14.34
32 West Contra Costa Co. to Oakland/Berkeley Rapid Bus	Bus	I-80	\$9.92	0.63	\$15.75
33 Sunset Muni Bus	Bus	San Francisco	\$6.19	0.36	\$17.21
34 East Contra Costa to Tri-Valley Rapid Bus	Bus	SR-4	\$2.23	0.12	\$18.60
35 Sonoma/Marin Commuter Rail (NWP)	Rail	Golden Gate	\$24.03	1.2	\$20.03
36 Larkspur - San Francisco Ferry	Ferry	Golden Gate	\$9.77	0.476	\$20.53
37 Caltrain Electrification, Mass Transit Service, & Grade Separations Only	Rail	Peninsula	\$100.22	4.8	\$20.88
38 Tiburon - San Francisco - Mission Bay Ferry	Ferry	Golden Gate	\$2.18	0.102	\$21.35
39 VTA Tasman LRT to Fremont BART	Rail	Fremont-South Bay	\$54.96	2.55	\$21.55
40 Intra Sonoma County Rapid Bus	Bus	Golden Gate	\$2.64	0.12	\$21.97
41 Downtown San Jose/East Valley LRT along Santa Clara St/Alum Rock Ave (Diridon Station to Capitol LRT Line)(2)	Rail	Santa Clara Valley	\$21.14	0.84	\$25.17
42 BART to Livermore + Dublin infill (3 station)	Rail	I-580	\$75.95	2.94	\$25.83
43 Caltrain Electrification, Mass Transit Svc, Downtown Ext., Grade Separations	Rail	Peninsula	\$157.01	6	\$26.17
44 West Contra Costa Co. to San Francisco Rapid Bus	Bus	I-80	\$1.64	0.06	\$27.27
45 Capitol Expressway (Capitol LRT Line to Eastridge Mall)(2)	Rail	Santa Clara Valley	\$18.93	0.69	\$27.44
46 Tri-Valley to Silicon Valley Rapid Bus	Bus	I-680 South	\$8.47	0.3	\$28.24
47 Capitol Corridor Upgrade	Rail	I-80	\$24.76	0.876	\$28.27
48 3rd Street LRT Extension to Chinatown	Rail	San Francisco	\$45.72	1.53	\$29.88
49 Solano Co. to East Bay (I-80) Rapid Bus	Bus	I-80	\$1.86	0.06	\$31.04
50 BART to Warm Springs and VTA LRT to Warm Springs	Rail	Fremont-South Bay	\$87.78	2.55	\$34.42
51 Expanded Interim VTA Commuter Rail Service	Rail	Fremont-South Bay	\$47.97	1.38	\$34.76
52 Tri-Valley to Central San Mateo/Alameda Co. Rapid Bus	Bus	I-580	\$3.33	0.09	\$36.98
53 Marin to Contra Costa Rapid Bus	Bus	Golden Gate	\$3.57	0.09	\$39.62
54 BART to Pittsburg (1 station)	Rail	SR-4	\$24.65	0.54	\$45.65
55 Dumbarton Rail (MTC Alignment)	Rail	Transbay	\$16.15	0.33	\$48.94
56 Downtown San Jose/East Valley LRT on Capitol Expressway (Eastridge Mall to Guadalupe LRT Line) (2)	Rail	Santa Clara Valley	\$24.09	0.45	\$53.54
57 San Jose Airport Rail Connector	Rail	Santa Clara Valley	\$21.56	0.33	\$65.32
58 Oakland Airport - San Francisco Ferry	Ferry	Transbay	\$5.27	0.068	\$77.56

(continued)

Figure 17

Ranking of Blueprint Projects by Cost Per New Rider
(low cost to high cost)

Blueprint Project	Type	Corridor	Total Annualized Capital & Net Operating Costs (millions)	New Riders (Annualized) (millions)	Cost / New Rider
59 BART to San Jose (1)	Rail	Fremont-South Bay	\$346.69	3.45	\$100.49
60 Vallejo - San Francisco Ferry	Ferry	Transbay	\$17.79	0.17	\$104.63
61 Port Sonoma - San Francisco Ferry	Ferry	Golden Gate	\$1.83	0.017	\$107.63
62 SFO - Moffett Field Ferry	Ferry	Peninsula	\$5.03	0.034	\$148.00
63 Moffett - Mission Bay - San Francisco Ferry	Ferry	Peninsula	\$10.32	0.068	\$151.79
64 Benicia - Martinez - San Francisco Ferry	Ferry	I-80	\$2.59	0.017	\$152.16
65 Oakland - Treasure Island Ferry	Ferry	Transbay	\$2.86	0.017	\$168.12
66 Berkeley - Treasure Island Ferry	Ferry	Transbay	\$2.86	0.017	\$168.12
67 Oakland Army Base- San Francisco Ferry	Ferry	Transbay	\$2.89	0.017	\$169.98
68 SFO - San Francisco Ferry	Ferry	Peninsula	\$13.37	0.068	\$196.68
69 BART infill @ 30th/Mission (1 station)	Rail	San Francisco	\$8.10	0.03	\$270.00
70 San Leandro - Redwood City Ferry	Ferry	Transbay	\$9.18	0.034	\$270.05
71 Redwood City - Mission Bay - San Francisco Ferry	Ferry	Peninsula	\$7.16	0.017	\$421.05
72 Alameda - Hunters Point Ferry	Ferry	Transbay	\$8.03	0.017	\$472.08
73 Harbor Bay - San Francisco Ferry	Ferry	Transbay	\$8.11	0.017	\$477.06
74 Oakland - Alameda - San Francisco Ferry	Ferry	Transbay	\$8.25	0.017	\$485.15
75 San Leandro - Moffett Field Ferry	Ferry	Transbay	\$9.02	0.017	\$530.80
76 Berkeley - San Francisco Ferry- Mission Bay Alameda Ferry	Ferry	Transbay	\$10.51	0.017	\$617.98

Notes

(1) Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) BART to San Jose Extension Study Update. The cost and ridership information are subject to change upon conclusion of this Study Update.

(2) Information provided by project sponsor (VTA) and not evaluated as part of the larger Blueprint package of rail projects.

Figure 18
Ranking of Blueprint Projects by Cost Per New Rider by Corridor
 (low cost to high cost)

Blueprint Project	Type	Capital (1999\$) (millions)	Net Annual Operating Cost (1999\$) (millions)	New Riders (Daily)	Cost / New Rider
Fremont-South Bay					
San Joaquin Co., Tri-Valley, Hayward, Fremont to Santa Clara Co. Rapid Bus	Bus	\$20.00	\$12.00	5,000	\$9.68
VTA Tasman LRT to Fremont BART	Rail	\$500.00	\$14.46	8,500	\$21.55
BART to Warm Springs and VTA LRT to Warm Springs	Rail	\$870.20	\$17.29	8,500	\$34.42
Expanded Interim VTA Commuter Rail Service	Rail	\$470.00	\$9.90	4,600	\$34.76
BART to San Jose (1)	Rail	\$4,053.00	\$18.40	11,500	\$100.49
Golden Gate					
Intra Marin County Rapid Bus	Bus	\$2.46	\$3.48	6,300	\$2.01
Sausalito - San Francisco Ferry	Ferry	\$4.23	\$0.04	400	\$3.21
Sonoma/Marin to San Francisco Rapid Bus	Bus	\$12.67	\$12.86	5,800	\$8.31
Sonoma/Marin Commuter Rail (NWP)	Rail	\$189.80	\$8.66	4,000	\$20.03
Larkspur - San Francisco Ferry	Ferry	\$49.72	\$5.10	1,400	\$20.53
Tiburon - San Francisco - Mission Bay Ferry	Ferry	\$7.21	\$1.50	300	\$21.35
Intra Sonoma County Rapid Bus	Bus	\$4.58	\$2.06	400	\$21.97
Marin to Contra Costa Rapid Bus	Bus	\$2.11	\$3.30	300	\$39.62
Port Sonoma - San Francisco Ferry	Ferry	\$16.38	\$0.29	50	\$107.63
I-580					
Intra-Tri-Valley Rapid Bus	Bus	\$1.76	\$1.63	2,800	\$2.20
San Joaquin to Tri-Valley, Dublin/Pleasanton					
BART Rapid Bus	Bus	\$2.00	\$1.50	1,400	\$4.17
BART to Livermore + Dublin infill (3 station)	Rail	\$927.00	\$0.87	9,800	\$25.83
Tri-Valley to Central San Mateo/Alameda Co. Rapid Bus	Bus	\$6.34	\$2.53	300	\$36.98
I-680 North					
Intra-Central Contra Costa Rapid Bus	Bus	\$5.98	\$3.03	1,500	\$8.41
Solano to East Bay (I-680) Rapid Bus	Bus	\$2.11	\$0.78	300	\$11.62
Central Contra Costa to North Oakland/Berkeley Rapid Bus	Bus	\$4.22	\$1.22	500	\$11.68
I-680 South					
ACE Upgrade	Rail	\$81.89	\$4.86	3,400	\$11.27
Tri-Valley to Silicon Valley Rapid Bus	Bus	\$14.78	\$6.61	1,000	\$28.24
I-80					
Intra West Contra Costa Co. Rapid Bus	Bus	\$0.70	\$0.36	2,000	\$0.75
Intra-Solano County Rapid Bus	Bus	\$1.06	\$1.07	1,200	\$3.34
Solano to San Francisco Rapid Bus	Bus	\$4.22	\$1.03	400	\$13.02
West Contra Costa Co. to Oakland/Berkeley Rapid Bus	Bus	\$8.10	\$8.90	2,100	\$15.75
West Contra Costa Co. to San Francisco Rapid Bus	Bus	\$2.11	\$1.37	200	\$27.27
Capitol Corridor Upgrade	Rail	\$187.20	\$9.60	2,400	\$28.27

(continued)

Figure 18

Ranking of Blueprint Projects by Cost Per New Rider by Corridor
(low cost to high cost)

Blueprint Project	Type	Capital (1999\$) (millions)	Net Annual Operating Cost (1999\$) (millions)	New Riders (Daily)	Cost / New Rider
Solano Co. to East Bay (I-80) Rapid Bus	Bus	\$4.22	\$1.33	200	\$31.04
Benicia - Martinez - San Francisco Ferry	Ferry	\$22.20	\$0.50	50	\$152.16
I-880					
Intra Oakland-Berkeley Rapid Bus	Bus	\$7.39	\$4.33	8,500	\$2.06
South Alameda to Silicon Valley Rapid Bus	Bus	\$2.50	\$6.80	2,300	\$10.31
Oakland Airport Rail Connector	Rail	\$134.00	\$0.39	3,100	\$12.09
Hayward-San Leandro to Silicon Valley Rapid Bus	Bus	\$8.72	\$4.80	1,500	\$13.11
Hayward-San Leandro to Oakland/Berkeley Rapid Bus	Bus	\$6.34	\$5.81	1,600	\$13.77
North Bay East-West					
Napa Co. to Solano Co. Rapid Bus	Bus	\$1.41	\$0.36	200	\$8.96
Peninsula					
Intra-San Mateo Co. Rapid Bus	Bus	\$8.80	\$6.94	8,300	\$3.23
South/Central/North San Mateo to San Francisco Rapid Bus	Bus	\$14.08	\$7.53	8,200	\$3.78
South/Central San Mateo to Colma BART/Silicon Valley Rapid Bus	Bus	\$13.28	\$3.92	3,000	\$6.21
Caltrain Mass Transit Service & Grade Separations Only	Rail	\$347.13	\$32.10	14,000	\$14.34
Caltrain Electrification, Mass Transit Service, & Grade Separations Only	Rail	\$749.62	\$39.50	16,000	\$20.88
Caltrain Electrification, Mass Transit Svc, Downtown Ext., Grade Separations	Rail	\$1,450.72	\$39.50	20,000	\$26.17
SFO - Moffett Field Ferry	Ferry	\$28.00	\$2.40	100	\$148.00
Moffett - Mission Bay - San Francisco Ferry	Ferry	\$24.70	\$8.00	200	\$151.79
SFO - San Francisco Ferry	Ferry	\$21.00	\$11.40	200	\$196.68
Redwood City - Mission Bay - San Francisco Ferry	Ferry	\$18.70	\$5.40	50	\$421.05
San Francisco					
Mission/Bay View Muni Bus	Bus	\$10.21	\$8.09	8,800	\$3.55
Richmond District Muni Bus	Bus	\$5.98	\$6.43	5,300	\$4.52
Sunset Muni Bus	Bus	\$5.98	\$5.44	1,200	\$17.21
3rd Street LRT Extension to Chinatown	Rail	\$536.00	\$2.30	5,100	\$29.88
BART infill @ 30th/Mission (1 station)	Rail	\$100.00	\$0.00	100	\$270.00
Santa Clara Valley					
Intra-Santa Clara County Rapid Bus	Bus	\$19.01	\$13.59	12,000	\$3.55
Downtown San Jose/East Valley Bus Rapid Transit on Monterey Highway (Diridon Station to Santa Teresa LRT Station)(2)	Bus	\$29.30	\$1.40	3,200	\$3.93
Downtown San Jose/East Valley LRT along Santa Clara St/Alum Rock Ave (Diridon Station to Capitol LRT Line)(2)	Rail	\$242.50	\$1.50	2,800	\$25.17

(continued)

Figure 18

Ranking of Blueprint Projects by Cost Per New Rider by Corridor
(low cost to high cost)

Blueprint Project	Type	Capital (1999\$) (millions)	Net Annual Operating Cost (1999\$) (millions)	New Riders (Daily)	Cost / New Rider
Downtown San Jose/East Valley LRT on Capitol Expressway (Capitol LRT Line to Eastridge Mall)(2)	Rail	\$210.30	\$1.90	2,300	\$27.44
Downtown San Jose/East Valley LRT on Capitol Expressway (Eastridge Mall to Guadalupe LRT Line) (2)	Rail	\$264.10	\$2.70	1,500	\$53.54
San Jose Airport Rail Connector	Rail	\$257.50	\$0.70	1,100	\$65.32
SR-4					
East Contra Costa to BART Rapid Bus	Bus	\$1.06	\$1.12	900	\$4.64
East Contra Costa to Tri-Valley Rapid Bus	Bus	\$4.22	\$1.70	400	\$18.60
BART to Pittsburg (1 station)	Rail	\$303.50	\$0.07	1,800	\$45.65
Transbay					
South/Central Alameda to San Francisco Rapid Bus	Bus	\$3.17	\$1.56	2,000	\$3.27
East Bay to Central San Mateo Co. Rapid Bus	Bus	\$3.87	\$2.31	1,000	\$9.33
Richmond - San Francisco - Mission Bay - South San Francisco Ferry	Ferry	\$22.00	\$6.90	2,000	\$13.19
Dumbarton Rail (MTC Alignment)	Rail	\$150.00	\$4.00	1,100	\$48.94
Oakland Airport - San Francisco Ferry	Ferry	\$21.00	\$3.30	200	\$77.56
Vallejo - San Francisco Ferry	Ferry	\$72.20	\$11.00	500	\$104.63
Oakland - Treasure Island Ferry	Ferry	\$7.00	\$2.20	50	\$168.12
Berkeley - Treasure Island Ferry	Ferry	\$7.00	\$2.20	50	\$168.12
Oakland Army Base- San Francisco Ferry	Ferry	\$8.40	\$2.10	50	\$169.98
San Leandro - Redwood City Ferry	Ferry	\$14.70	\$7.80	100	\$270.05
Alameda - Hunters Point Ferry	Ferry	\$14.10	\$6.70	50	\$472.08
Harbor Bay - San Francisco Ferry	Ferry	\$15.00	\$6.70	50	\$477.06
Oakland - Alameda - San Francisco Ferry	Ferry	\$15.40	\$6.80	50	\$485.15
San Leandro - Moffett Field Ferry	Ferry	\$19.40	\$7.20	50	\$530.80
Berkeley - San Francisco Ferry- Mission Bay Alameda Ferry	Ferry	\$22.40	\$8.40	50	\$617.98

Notes

(1) Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) BART to San Jose Extension Study Update. The cost and ridership information are subject to change upon conclusion of this Study Update.

(2) Information provided by project sponsor (VTA) and not evaluated as part of the larger Blueprint package of rail projects.

CHAPTER 5

EVALUATION OF MAJOR HIGHWAY PROJECTS

This chapter evaluates two types of highway improvements as shown in Figure 19.

Carpool Lane – Carpool lane projects are selected projects from the Rapid Bus package that were designed to improve travel times for rapid bus riders and potential future carpoolers. In some locations the carpool lane network also included special HOV-to-HOV connector facilities to facilitate movement between carpool lanes on one freeway and the lanes on a connecting freeway.

Mixed-flow Lanes – Mixed-flow lanes include both new general-purpose lanes on highways as well as auxiliary lanes between freeway interchanges. The origin of projects in this category are either prior or ongoing corridor studies (e.g., MTC's *North Bay Corridor Study* for Route 37 and MTC's current *Route 24/Caldecott Tunnel Corridor Study*) or projects identified in prior or current county sales tax expenditure plans (e.g. the Route 84 expressway between Livermore and Sunol, and US 101 auxiliary lanes in Santa Clara/San Mateo counties). In order to evaluate these projects, a separate year 2020 travel demand forecast was prepared. (It should be noted that county sales tax plans are also considering a number of individual freeway interchange improvements, but these were not included in the modeling and would most likely not have a significant impact on our results).

Using an approach similar to the transit evaluation in Chapter 4, the highway evaluation focuses on several areas: congestion relief, travel time savings, cost, and cost effectiveness.

Congestion Relief - Caltrans collects information on freeway congestion throughout the Bay Area, the latest report being the *1998 Congestion Monitoring Report*. Figure 20 illustrates the growth in congestion over time in the Bay Area. In Figures 21 and 22, we show the 1998 vehicle hours of delay for the most congested freeway segments in the region, and also show the candidate Blueprint or RTP packages that would potentially address this congestion. (Note that some of the bottlenecks will be addressed by projects that are currently programmed or in the *1998 Regional Transportation Plan* or by major improvements under construction but not fully operational at the time of the monitoring.)

Highway Volumes - Projected highway volumes for individual projects and estimated person trips are shown in Figure 23 for the 2-hour morning (a.m.) peak.

Travel Time Savings (2-Hour AM Peak) - Travel time savings that a highway improvement could provide were derived by selecting relevant city origin and destination pairs for the corridors in which the highway improvements are located. The estimated travel time between these origins and destinations are compared to the expected travel time given the improvements in the *1998 Regional Transportation Plan*. Annual travel time savings are then aggregated for the 2-hour AM peak period after factoring in the number of corridor users. This data is shown for new mixed-flow lanes in Figure 24 and for new

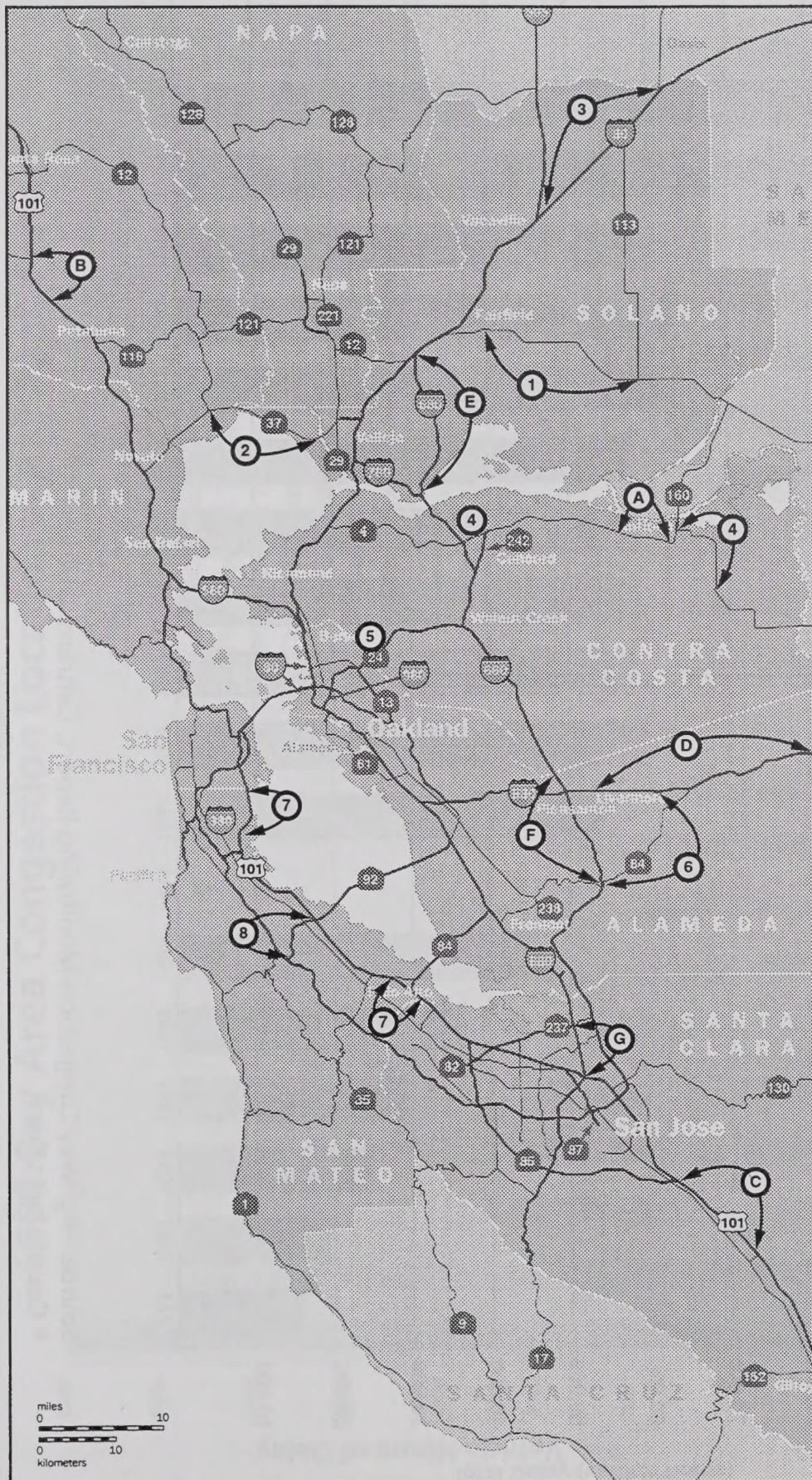
carpool lanes in Figure 25. (Note that this analysis does not take into account travel time savings on arterials that may accrue as a result of some trips shifting to the highways due to improved travel times.)

Traffic Volumes Compared to Capacity - Freeway level of service is calculated by comparing the volumes on a facility to the capacity. We have calculated the volume to capacity ratios in 2020 over the 2-hour AM peak period and compared these numbers with the Blueprint and the 1998 RTP base. These results are also shown in Figures 24 and 25. Note that volume capacity ratios over 1.00 indicate significant congestion. For the carpool lane facilities, the volume/capacity ratios are provided both for the mixed-flow lanes and the new carpool lane. *The Appendix contains a more complete inventory of volume to capacity ratios at key screenlines throughout the region.*

Cost Effectiveness - The conceptual capital cost for the various highway projects is as contained in the final *Blueprint Project Notebook* (June 2000). We next define cost effectiveness as the annualized capital cost of a project compared to the annual trips in the peak direction for the 2 hour a.m. peak period. (Since we are evaluating trips in one direction, we divide the capital cost by two). Figure 26 shows the results of this calculation.

Figure 19

Blueprint Road Projects



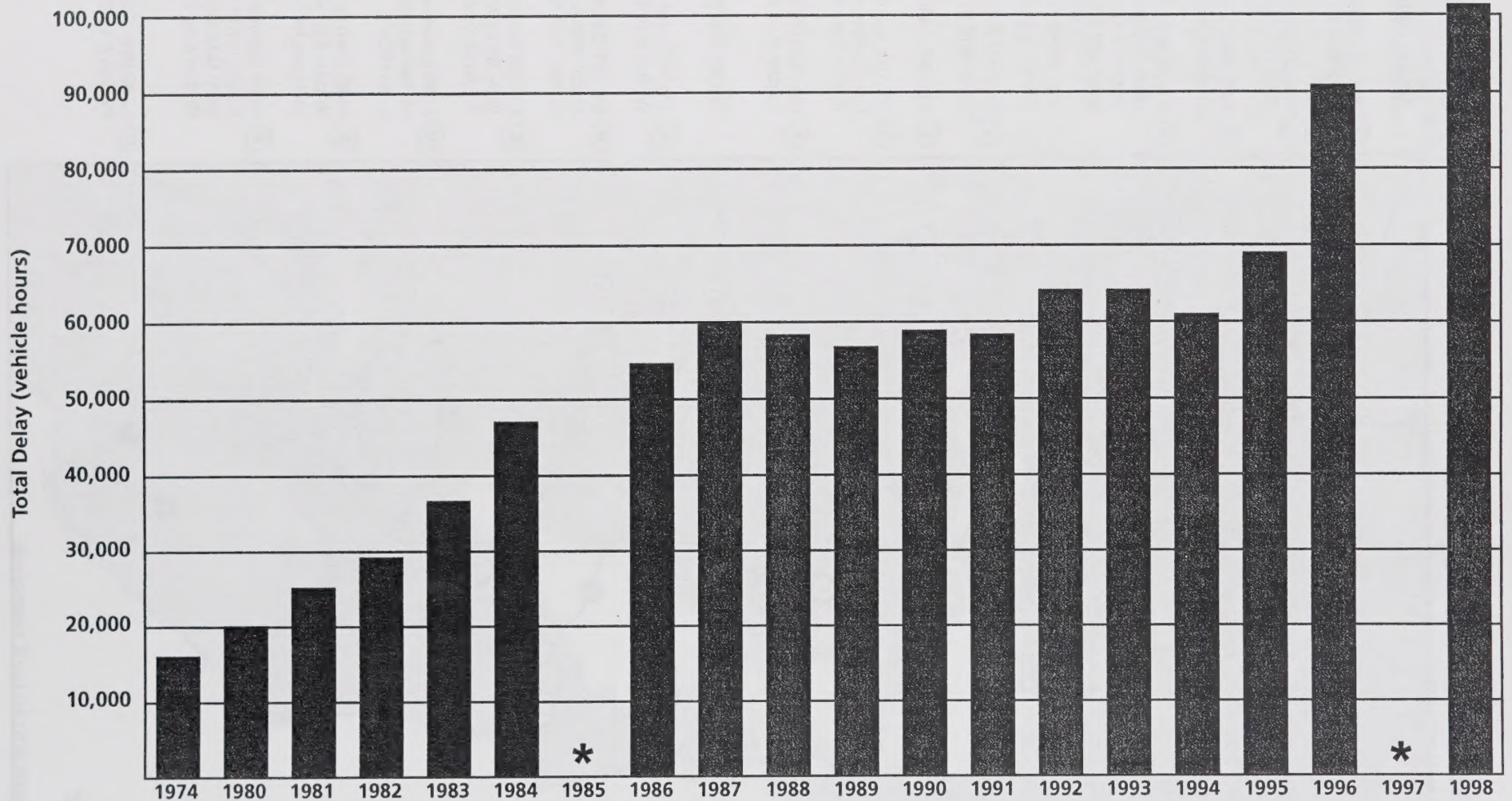
Mixed Flow Lanes

- ① Rte. 12 (I-80 to Rio Vista): Upgrade to Expressway
- ② Rte. 37 (Napa River to Rte. 121): Widen 2 to 4 Lanes
- ③ I-80 (Rte. 113 to I-505): Widen 6 to 8 Lanes
- ④ Rte. 4 Bypass (Rte. 160 to Walnut Blvd.): Widen 2 to 4 Lanes and Upgrade to Freeway -and- Rte. 4 (I-680 to Rte. 242): Widen 4 to 8 Lanes
- ⑤ Rte. 24: Add 4th Bore at Caldecott Tunnel (2 Lanes)
- ⑥ Rte. 84 : Widen 2 to 6 Lanes
- ⑦ US-101 Auxiliary Lanes: Grand Ave. to SM/SF Line & Marsh Ave. to University Ave.
- ⑧ Rte. 92 (US-101 to I-280): Widen 4 to 6 Lanes

New Carpool Lanes

- A Rte. 4 (Somersville to Rte. 160): Widen 6 to 8 Lanes with HOV's
- B US-101 (South Santa Rosa to North Petaluma): HOV Gap Closure, Widen 4 to 6 Lanes with HOV's
- C US-101 Northbound & Southbound (Rte. 85 to Morgan Hill): Widen 6 to 8 Lanes with HOV's
- D I-580 (Alameda County Line to Tassajara): Widen 8 to 10 Lanes with HOV's
- E I-680 (I-80 to I-780): Widen 4 to 6 Lanes with HOV's Includes HOV Connector from I-80
- F I-680 (Alameda/Contra Costa County Line to Route 84): HOV Gap Closure, Widen 6 to 8 Lanes with HOV's
- G I-880 (Rte. 237 to US-101): Widen 6 to 8 Lanes with HOV's

Figure 20
Daily Bay Area Congestion
(vehicle hours)



Source: Highway Congestion Monitoring Report, Caltrans, District 4

* Counts not taken

Figure 21

1998 Bay Area Congestion Locations– AM Peak Period

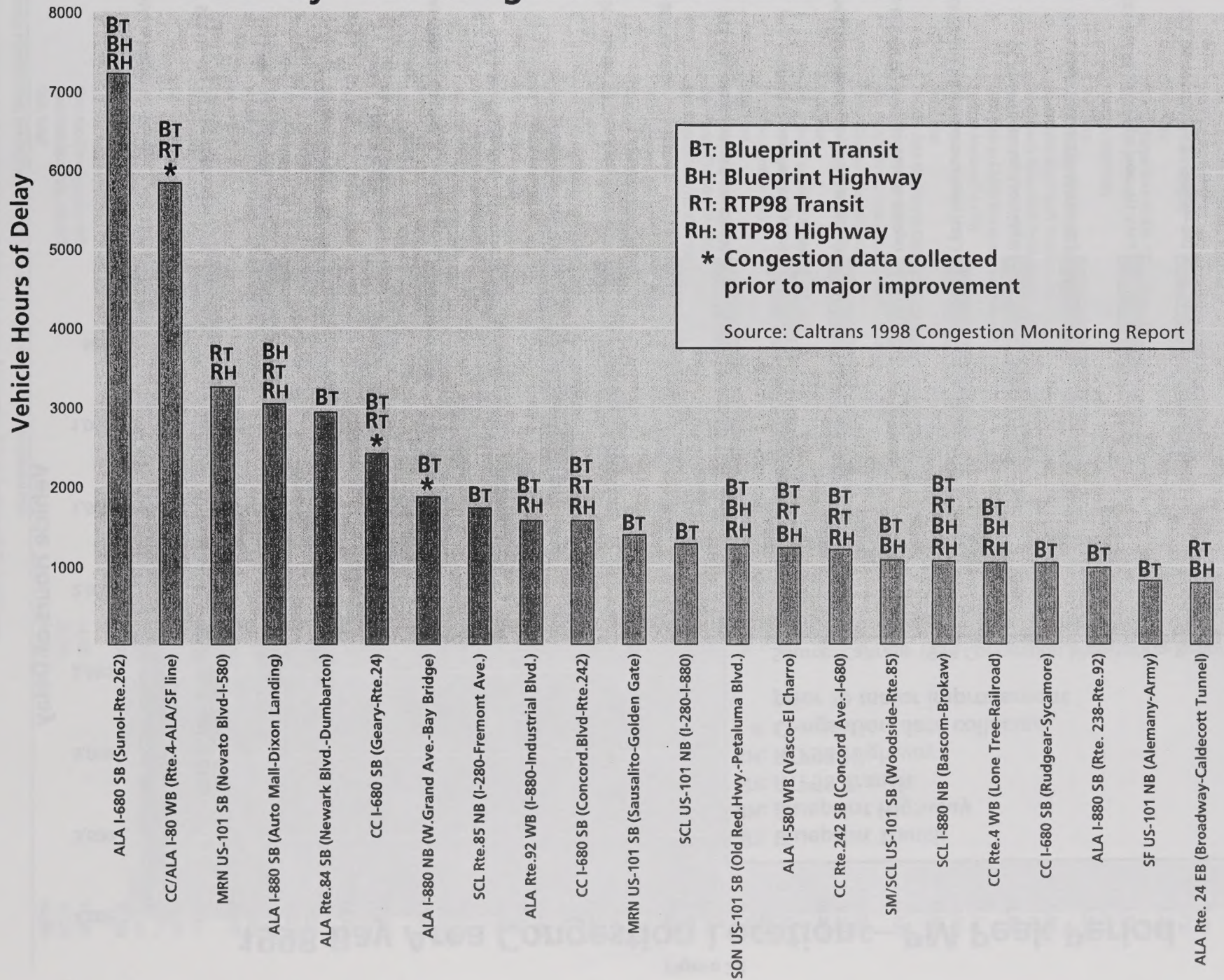


Figure 22

1998 Bay Area Congestion Locations– PM Peak Period

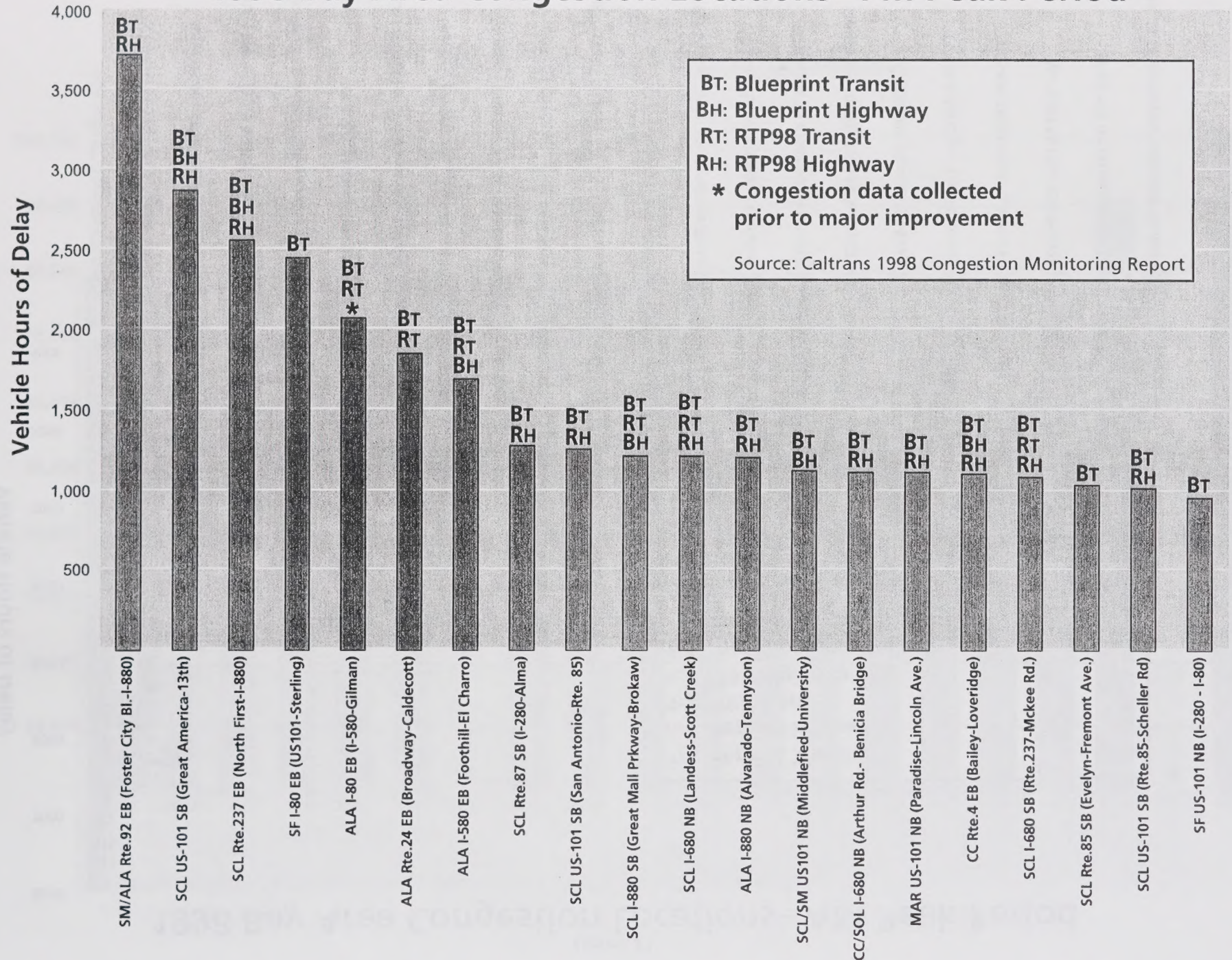


Figure 23

Highway Volumes (Year 2020, Peak Period, 2-Way)

Person Trips (Road Package & Rapid Bus/HOV Package)
A.M. 2-Hour Peak Period

Project Ref. #	Facility	Volume ¹	Person Trips ²
1	Rte. 12 (I-80 to Rio Vista): Upgrade to Expressway		
	Rio Vista-Fairfield (WB)	2,900	3,625
	Fairfield-Rio Vista (EB)	1,400	1,750
	Sub-Total	4,300	5,375
2	Rte. 37 (Napa River to Rte. 121): Widen 2 to 4 Lanes		
	Vallejo-Novato (WB)	4,500	5,625
	Novato-Vallejo (EB)	2,300	2,875
	Sub-Total	6,800	8,500
B	US-101 (South Santa Rosa to North Petaluma) - HOV Gap Closure: Widen 4 to 6 Lanes with HOV		
	South Santa Rosa-North Petaluma:DA (SB)	8,000	8,800
	South Santa Rosa-North Petaluma:HOV (SB)	1,650	3,746
	Sub-Total	9,650	12,546
E	I-680 (I-80 to I-780): Widen 4 to 6 Lanes with HOV		
	Fairfield-Martinez:DA (SB)	7,950	8,745
	Fairfield-Martinez:HOV (SB)	1,700	3,859
	Sub-Total	9,650	12,604
5	Rte. 24: Add 4th Bore at Caldecott Tunnel (A.M. Eastbound 2 Lanes Added)		
	Rockridge-Lafayette (EB)	11,700	14,625
8	Rte. 92 (US-101 to I-280): Widen 4 to 6 Lanes		
	Foster City-Half Moon Bay (WB)	8,000	10,000
	Half Moon Bay-Foster City (EB)	7,500	9,375
	Sub-Total	15,500	19,375
6	Rte. 84(I-580 to I-680): Widen 2 to 6 Lanes		
	Livermore-Fremont (SB)	8,700	10,875
	Fremont-Livermore (NB)	3,100	3,875
	Sub-Total	11,800	14,750
F	I-680 (Alameda/Contra Costa County Line to Route 84): HOV Gap Closure		
	San Ramon-Fremont:DA (SB)	13,700	15,070
	San Ramon-Fremont:HOV (SB)	2,900	6,583
	Sub-Total	16,600	21,653
A	Rte. 4 (Somersville to Rte. 160): Widen 6 to 8 Lanes with HOV		
	Sherman Island-Concord:DA (WB)	13,000	14,300
	Sherman Island-Concord:HOV (WB)	3,500	7,945
	Sub-Total	16,500	22,245
4	Rte. 4 By-Pass (Rte. 160 to Walnut Blvd.): Widen 2 to 4 Lanes and Upgrade to Freeway;		
	Rte. 4 (I-680 to Rte. 242): Widen 4 to 8 Lanes		
	Byron-Martinez (WB)	14,000	17,500
	Martinez-Byron (EB)	5,800	7,250
	Sub-Total	19,800	24,750
D	I-580 (Alameda County Line to Tassajara): Widen 8 to 10 Lanes with HOV		
	Altamont Pass-Dublin:DA (WB)	17,500	19,250
	Altamont Pass-Dublin:HOV (WB)	2,700	6,129
	Sub-Total	20,200	25,379
3	I-80 (Rte. 113 to I-505): Widen 6 to 8 Lanes		
	Davis-Vacaville (WB)	13,100	16,375
	Vacaville-Davis (EB)	9,400	11,750
	Sub-Total	22,500	28,125
C	US-101 (Rte. 85 to Morgan Hill): Widen 6 to 8 Lanes with HOV		
	South San Jose-Morgan Hill:DA (SB)	10,300	11,330
	Morgan Hill-South San Jose:DA (NB)	10,300	11,330
	South San Jose-Morgan Hill:HOV (SB)	1,400	3,178
	Morgan Hill-South San Jose:HOV (NB)	1,700	3,859
	Sub-Total	23,700	29,697
G	I-880 (Rte. 237 to US-101): Widen 6 to 8 Lanes with HOV		
	Fremont-San Jose:DA (SB)	14,400	15,840
	San Jose-Fremont:DA (NB)	9,000	9,900
	Fremont-San Jose:HOV (SB)	3,000	6,810
	San Jose-Fremont:HOV (NB)	1,050	2,384
	Sub-Total	27,450	34,934
7	US-101 Auxiliary Lanes: Grand Ave. to SM/SF Line & Marsh Ave. to University Ave.		
	Palo Alto-San Francisco (NB)	14,000	17,500
	San Francisco-Palo Alto (SB)	20,000	25,000
	Sub-Total	34,000	42,500

¹Approximate volumes along selected segment based on an average of volumes for few selected links

²Person-Trips = (Volume) x 1.25 for mixed flow; & (Volume) x 1.1 for DA, & (Volume) x 2.27 for facilities with DA & HOV lanes

Figure 24
HIGHWAY EVALUATION - New Mixed Flow Lanes
(Year 2020, 2 Hour, Peak Direction)

Project Ref #	Project / Peak Direction	Description	Vehicle Volumes	Volume / Capacity		Person Trips	Travel Time Saved (minutes)	Annual Person Hours Saved
				RTP	Blueprint			
6	SR 84 SB	Widen 2 to 6 Lanes I-580 to I-680	8,700	1.26	0.97	10,875	13.18	597,200
5	SR 24 EB	A.M. Eastbound 2 Lanes Added Add 4th Bore at Caldecott Tunnel	11,700	1.30	0.74	14,625	2.48	151,100
4	SR 4 WB	Widen 2 to 4 Lanes and Upgrade to Freeway >>SR 160 to Walnut Blvd	14,000*	0.72	0.64	17,500*	2.02*	147,300*
		Widen 4 to 8 Lanes >>I-680 to SR 242	-	1.21	0.76	-	-	-
7	US 101 SB	Auxiliary Lanes >>Grand Ave. to SM/SF Line	20,000*	1.03	0.87	25,000*	1.19*	124,000*
		>>Marsh Ave. to University Ave.	-	1.19	1.01	-	-	-
1	SR 12 WB	Upgrade to Expressway I-80 to Rio Vista	2,900	1.08	0.98	3,625	7.61	115,000
3	I-80 WB	Widen 6 to 8 Lanes SR 113 to I-505	13,100	1.09	0.85	16,375	1.45	98,900
8	SR 92 EB	Widen 4 to 6 Lanes US 101 to I-280	7,500	0.73	0.52	9,375	2.12	82,800
2	SR 37 WB	Widen 2 to 4 Lanes Napa River to SR 121	4,500	1.00	0.57	5,625	1.99	46,600

Note

*Represents combined numbers for both segments

Figure 25
HIGHWAY EVALUATION - New Carpool Lanes
(Year 2020, 2 Hour, Peak Direction)

Project Ref #	Project / Peak Direction	Description	Vehicle Volumes	Volume / Capacity		Person Trips	Travel Time Saved (minutes)	Annual Person Hours Saved
				RTP	Blueprint			
F	I-680	HOV Gap Closure	13,700 MF	1.04	1.00	15,070	3.94	247,400
	SB	Alameda/Contra Costa County Line to SR 84	2,900 HOV		0.77	6,583	8.67	237,800
						21,653		485,200
D	I-580	Widen 8 to 10 Lanes with HOV	17,500 MF	1.11	1.06	19,250	2.9	232,600
	WB	Alameda County Line to Tassajara	2,700 HOV		0.69	6,129	5.32	135,900
						25,379		368,500
A	SR 4	Widen 6 to 8 Lanes with HOV	13,000 MF	1.22	1.16	14,300	0.83	49,500
	WB	Somersville to SR 160	3,500 HOV		0.70	7,945	1.75	57,900
						22,245		107,400
E	I-680	Widen 4 to 6 Lanes with HOV	7,950 MF	1.01	0.94	8,745	1.31	47,700
	SB	I-80 to I780	1,700 HOV		0.36	3,859	2.22	35,700
						12,604		83,400
B	US 101	Widen 4 to 6 Lanes with HOV	8,000 MF	1.07	0.96	8,800	1.14	41,800
	SB	South Santa Rosa to North Petaluma	1,650 HOV		0.37	3,746	1.92	30,000
						12,546		71,800
G	I-880	Widen 6 to 8 Lanes with HOV	14,400 MF	1.11	1.07	15,840	0.56	37,000
	SB	SR 237 to US 101	3,000 HOV		0.71	6,810	1.05	29,800
						22,650		66,800
C	US 101	Widen 6 to 8 Lanes with HOV	10,300 MF	1.00	0.91	11,330	0.94	44,400
	SB	SR 85 to Morgan Hill	1,400 HOV		0.42	3,178	1.48	19,600
						14,508		64,000

Figure 26
HIGHWAY COST COMPARISONS
(COST PER PEAK PERIOD PERSON TRIPS (2000))

Project Ref #	Project / Peak Direction	Description	Directional Cost ¹ (millions)	Annualized Directional Cost (millions)	Daily Trips	Annual Trips ² (millions)	Annualized Cost / Annual Person Trips ³ (millions)
F	I-680 SB	HOV Gap Closure Alameda/Contra Costa County Line to SR 84	13.4	1.3	21,653	5.41	0.24
C	US 101 SB	Widen 6 to 8 Lanes with HOV SR 85 to Morgan Hill	10.0	0.9	14,508	3.63	0.25
7	US 101 SB	Auxiliary Lanes >>Grand Ave. to SM/SF Line >>Marsh Ave. to University Ave.	25.8	2.4	25,000	6.25	0.38
3	I-80 WB	Widen 6 to 8 Lanes SR 113 to I-505	17.3	1.6	16,375	4.09	0.39
D	I-580 WB	Widen 8 to 10 Lanes with HOV Alameda County Line to Tassajara	30.9	2.9	25,379	6.34	0.46
A	SR 4 WB	Widen 6 to 8 Lanes with HOV Somersville to SR 160	34.5	3.2	22,245	5.56	0.58
1	SR 12 WB	Upgrade to Expressway I-80 to Rio Vista	7.0	0.70	3,625	0.91	0.77
E	I-680 SB	Widen 4 to 6 Lanes with HOV I-80 to I-780	28.6	2.7	12,604	3.15	0.86

Figure 26 (continued)

HIGHWAY COST COMPARISONS **(COST PER PEAK PERIOD PERSON TRIPS (2000))**

Project Ref #	Project / Peak Direction	Description	Directional Cost ¹ (millions)	Annualized Directional Cost (millions)	Daily Trips	Annual Trips ² (millions)	Annualized Cost / Annual Person Trips ³ (millions)
B	US 101 SB	Widen 4 to 6 Lanes with HOV South Santa Rosa to North Petaluma	38.6	3.6	12,546	3.14	1.15
4	SR 4 WB	Widen 2 to 4 Lanes and Upgrade to Freeway >>SR 160 to Walnut Blvd Widen 4 to 8 Lanes >>I-680 to SR 242	68.5	6.4	17,500	4.38	1.46
G	I-880 SB	Widen 6 to 8 Lanes with HOV SR 237 to US 101	105.0	9.9	22,650	5.66	1.75
8	SR 92 EB	Widen 4 to 6 Lanes US 101 to I-280	50.0	4.7	9,375	2.34	2.01
6	SR 84 SB	Widen 2 to 6 Lanes I-580 to I-680	90.0	8.5	10,875	2.72	3.13
5	SR 24 EB	A.M. Eastbound 2 Lanes Added Add 4th Bore at Caldecott Tunnel	104.0	9.8	14,625	3.66	2.68
2	SR 37 WB	Widen 2 to 4 Lanes Napa River to SR 121	77.3	7.3	5,625	1.41	5.19

Notes¹Half Total Project Cost²Annual Person Trips = Daily Person Trips*250 days³Annualized Cost / Annual Person Trips = Annualized Directional Cost divided by Annual Trips

APPENDICES

Appendix A: Projected Transit Boardings by Operator for Various Transit Packages

Appendix B: Highway Screenline Volumes Compared to Capacity by 2020

Appendix A

Blueprint: Compare Sub-Operator Transit Boardings : All Alternatives - Includes Adjustments

Operator/Sub-Operator	Base	Bus	Ferry	Rail1 ¹	Rail2 ²	Change from Base			
						Bus	Ferry	Rail1 ¹	Rail2 ²
BART	373,300	350,500	364,100	415,800	393,200	-22,800	-9,200	42,500	19,900
Oakland Airport Rail	-	-	-	5,900	5,900	0	0	5,900	5,900
Transbay	10,700	20,600	10,700	11,300	11,200	9,900	0	600	500
Northern Alameda/Contra Costa	208,500	231,500	201,400	206,800	206,500	23,000	-7,100	-1,700	-2,000
Central-Southern Alameda	49,600	53,500	48,500	51,800	51,200	3,900	-1,100	2,200	1,600
AC Transit Total	268,800	305,600	260,600	269,900	268,900	36,800	-8,200	1,100	100
WestCat/BART Express/30Z	4,700	8,800	4,600	4,300	4,300	4,100	-100	-400	-400
CCCTA/LAVTA/Tri-Delta/San Joa.*	40,200	54,700	40,300	41,300	42,500	14,500	100	1,100	2,300
Union City/DBX	3,600	2,800	3,600	3,900	3,900	-800	0	300	300
Emery/Berk & Brdwy Shuttle	11,200	6,400	15,300	7,100	7,100	-4,800	4,100	-4,100	-4,100
Small East Bay Operators	59,700	72,700	63,800	56,600	57,800	13,000	4,100	-3,100	-1,900
Capitols	5,200	4,900	5,200	8,200	9,100	-300	0	3,000	3,900
San Joaquins	600	400	600	1,300	1,300	-200	0	700	700
Capitols & San Joaquins	5,800	5,300	5,800	9,500	10,400	-500	0	3,700	4,600
Union City-San Jose Comm Rail	2,800	2,600	2,800	0	0	-200	0	-2,800	-2,800
ACE - Livermore to San Jose	2,800	2,300	2,800	4,600	5,700	-500	0	1,800	2,900
Dumb. Br. Rail - Pleasanton - Millbrae	0	0	0	3,000	3,100	0	0	3,000	3,100
South Bay-oriented Comm. Rai	5,600	4,900	5,600	7,600	8,800	-700	0	2,000	3,200

Appendix A

Blueprint: Compare Sub-Operator Transit Boardings : All Alternatives - Includes Adjustments

Operator/Sub-Operator	Base	Bus	Ferry	Rail1 ¹	Rail2 ²	Change from Base			
						Bus	Ferry	Rail1 ¹	Rail2 ²
Metro	139,600	132,100	138,800	142,300	142,200	-7,500	-800	2,700	2,600
Cable Cars	39,900	35,700	42,000	42,100	42,100	-4,200	2,100	2,200	2,200
Richmond District to Downtown	229,700	234,600	232,800	241,100	241,000	4,900	3,100	11,400	11,300
Mission/Bay View to Downtown	211,000	250,100	211,600	196,300	196,000	39,100	600	-14,700	-15,000
Other	260,700	259,300	262,100	267,700	267,500	-1,400	1,400	7,000	6,800
MUNI Total	880,900	911,800	887,300	889,500	888,800	30,900	6,400	8,600	7,900
Flyer	6,600	35,100	6,600	3,000	3,000	28,500	0	-3,600	-3,600
Coastal	4,600	6,000	4,600	4,600	4,600	1,400	0	0	0
Bayside	73,100	95,500	73,100	70,300	70,400	22,400	0	-2,800	-2,700
San Mateo Bridge	3,000	4,000	3,000	3,000	3,000	1,000	0	0	0
SamTrans Total	87,300	140,600	87,300	80,900	81,000	53,300	0	-6,400	-6,300
CalTrain	30,100	21,600	29,000	70,300	72,400	-8,500	-1,100	40,200	42,300
Local	213,600	210,000	212,900	213,100	214,800	-3,600	-700	-500	1,200
Express	7,100	29,900	7,100	4,100	6,000	22,800	0	-3,000	-1,100
LRT	39,500	37,000	40,600	38,300	46,600	-2,500	1,100	-1,200	7,100
SCVTA Total	260,200	276,900	260,600	255,500	267,400	16,700	400	-4,700	7,200
CT Shuttles	3,500	2,600	2,900	5,300	5,000	-900	-600	1,800	1,500
Stan Shuttles	7,000	8,600	7,000	7,900	8,000	1,600	0	900	1,000
VTA Shuttles	900	900	900	600	800	0	0	-300	-100
Ferry Shuttles	0	0	400	0	0	0	400	0	0
Shuttles	11,400	12,100	11,200	13,800	13,800	700	-200	2,400	2,400

Appendix A

Blueprint: Compare Sub-Operator Transit Boardings : All Alternatives - Includes Adjustments

Operator/Sub-Operator	Base	Bus	Ferry	Rail1 ¹	Rail2 ²	Change from Base			
						Bus	Ferry	Rail1 ¹	Rail2 ²
GGT to SF	59,300	72,300	53,600	50,500	50,600	13,000	-5,700	-8,800	-8,700
GGT Marin	6,900	13,500	6,600	6,300	6,300	6,600	-300	-600	-600
GGT to Richmond	100	1,700	100	100	100	1,600	0	0	0
GGT Ferry feeder	600	400	3,000	400	400	-200	2,400	-200	-200
Northwest Pacific Rail	0	0	0	14,000	14,000	0	0	14,000	14,000
Golden Gate Total	66,900	87,900	63,300	71,300	71,400	21,000	-3,600	4,400	4,500
Sonoma County	5,300	7,800	5,300	4,800	4,800	2,500	0	-500	-500
Petaluma	400	1,300	400	600	600	900	0	200	200
Santa Rosa	5,900	5,800	5,700	6,600	6,600	-100	-200	700	700
Small Sonoma Operators	11,600	14,900	11,400	12,000	12,000	3,300	-200	400	400
Napa VINE/Napa Valley	5,400	6,300	5,400	5,400	5,400	900	0	0	0
Benicia	1,100	1,700	1,100	1,100	1,100	600	0	0	0
Vallejo local	6,700	7,300	7,700	6,500	6,500	600	1,000	-200	-200
Vallejo BART Link	3,400	5,400	3,200	3,000	3,000	2,000	-200	-400	-400
Fairfield/Suisun/Vacaville	3,500	4,200	3,500	3,300	3,300	700	0	-200	-200
Solano and Napa Operators	20,100	24,900	20,900	19,300	19,300	4,800	800	-800	-800
Larkspur Ferry	3,700	4,700	6,500	17,300	17,300	1,000	2,800	13,600	13,600
Sausalito Ferry	1,400	1,600	2,200	1,400	1,400	200	800	0	0
Tiburon Ferry	1,000	1,100	1,500	700	700	100	500	-300	-300
Vallejo Ferry	2,200	2,000	3,200	2,200	2,200	-200	1,000	0	0
Existing East Bay Ferries	1,400	1,400	8,200	1,300	1,300	0	6,800	-100	-100
New North Bay Ferries	0	0	100	0	0	0	100	0	0
New Other Ferries	0	0	4,900	0	0	0	4,900	0	0
Ferries	9,700	10,800	26,600	22,900	22,900	1,100	16,900	13,200	13,200
Bay Area Total	2,091,400	2,240,500	2,097,500	2,200,800	2,194,000	149,100	6,100	109,400	102,600

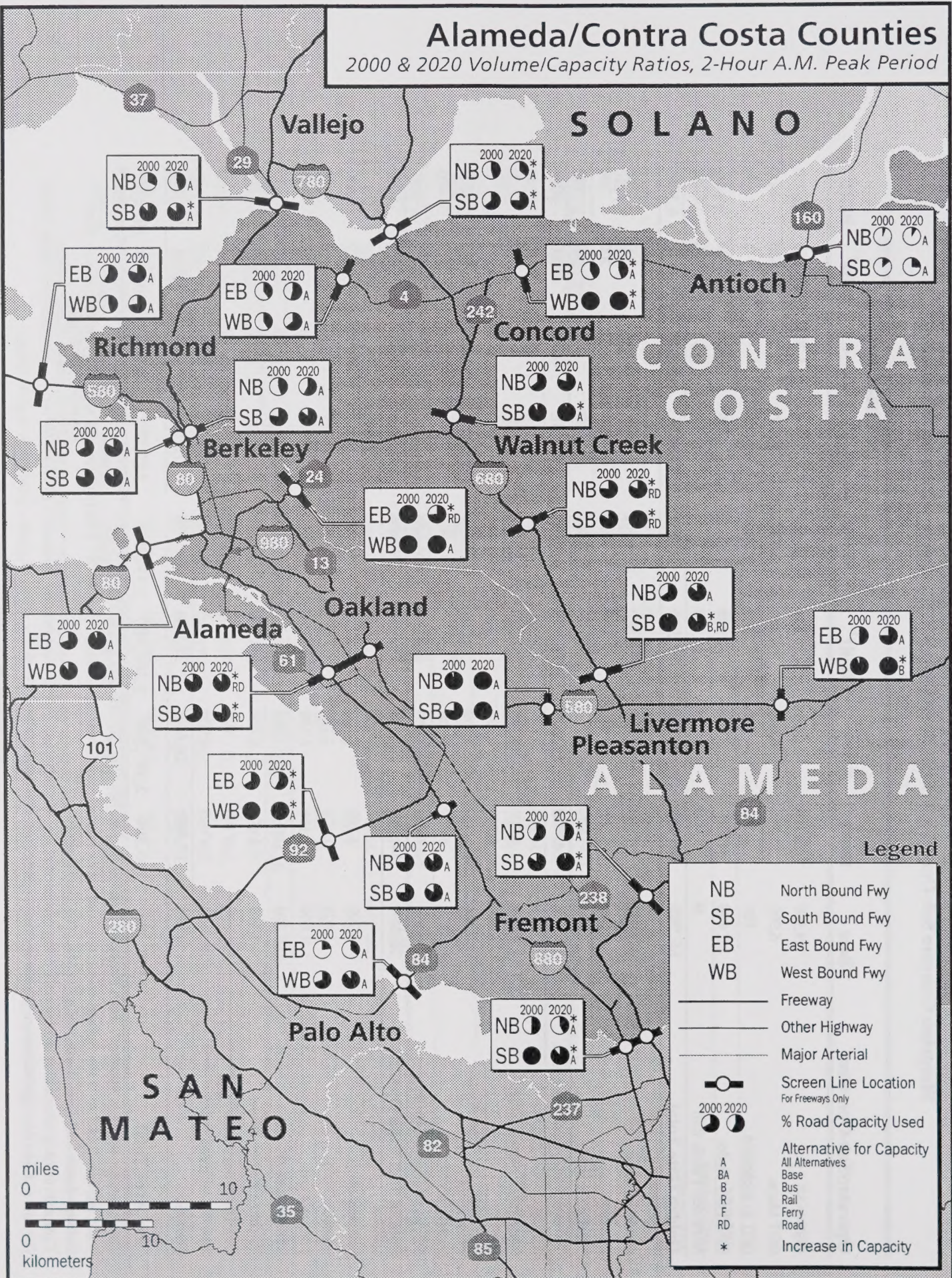
¹Rail1 includes BART to San Jose³. Both BART lines (Richmond & Daly City) are extended to San Jose.

²Rail2 includes BART to Warm Springs connecting with LRT extended from Santa Clara County. Both BART lines (Richmond & Daly City) are extended to Warm Springs. A new LRT from Warm Springs to Mountain view is added.

³Cost and ridership information are currently being evaluated as part of Santa Clara Valley Transportation Authority's (VTA) *BART to San Jose Extension Study Update*. The cost and ridership information are subject to change upon conclusion of this Study Update.

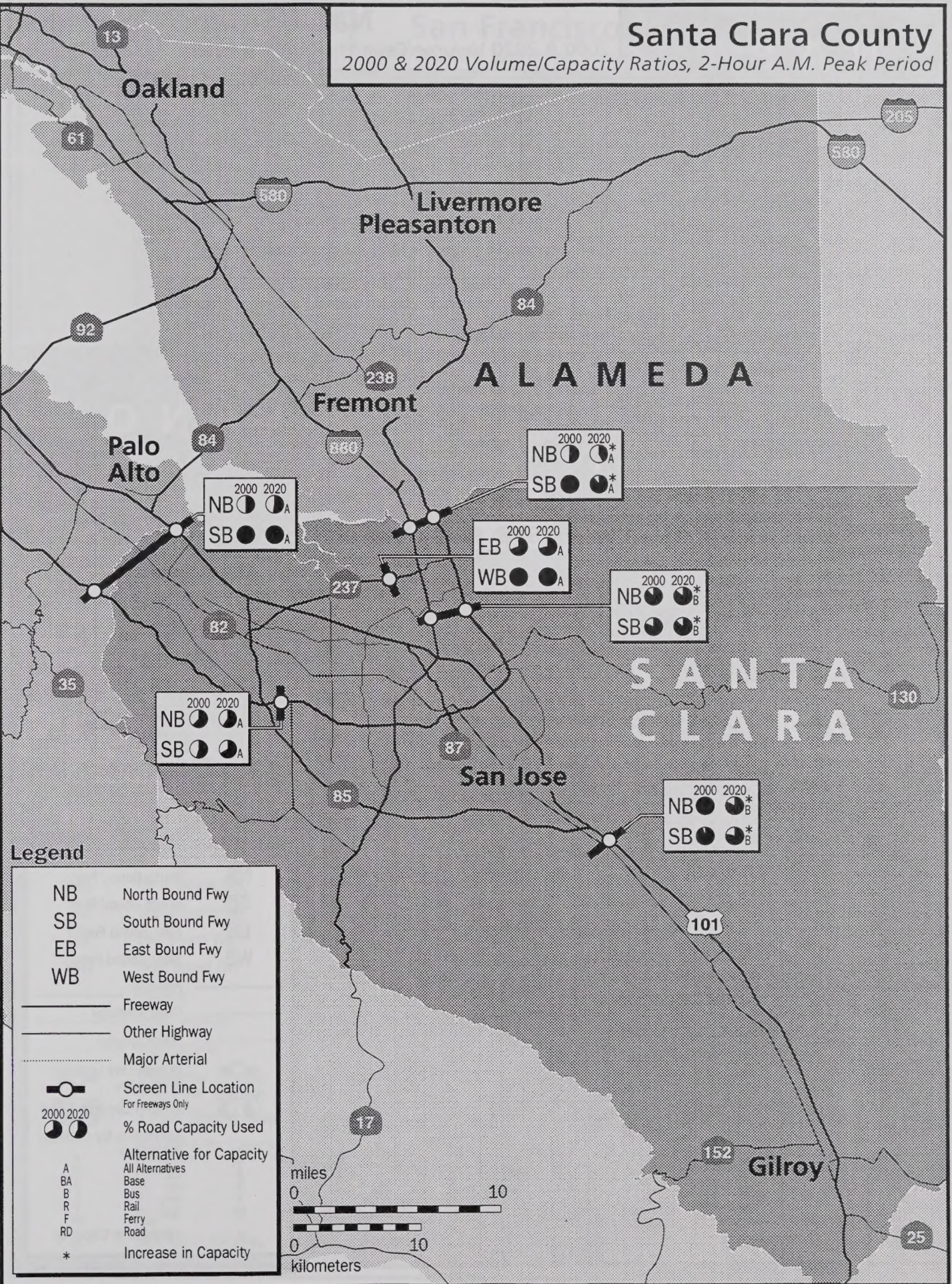
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2000 & 2020 Volume/Capacity Ratios, 2-Hour A.M. Peak Period



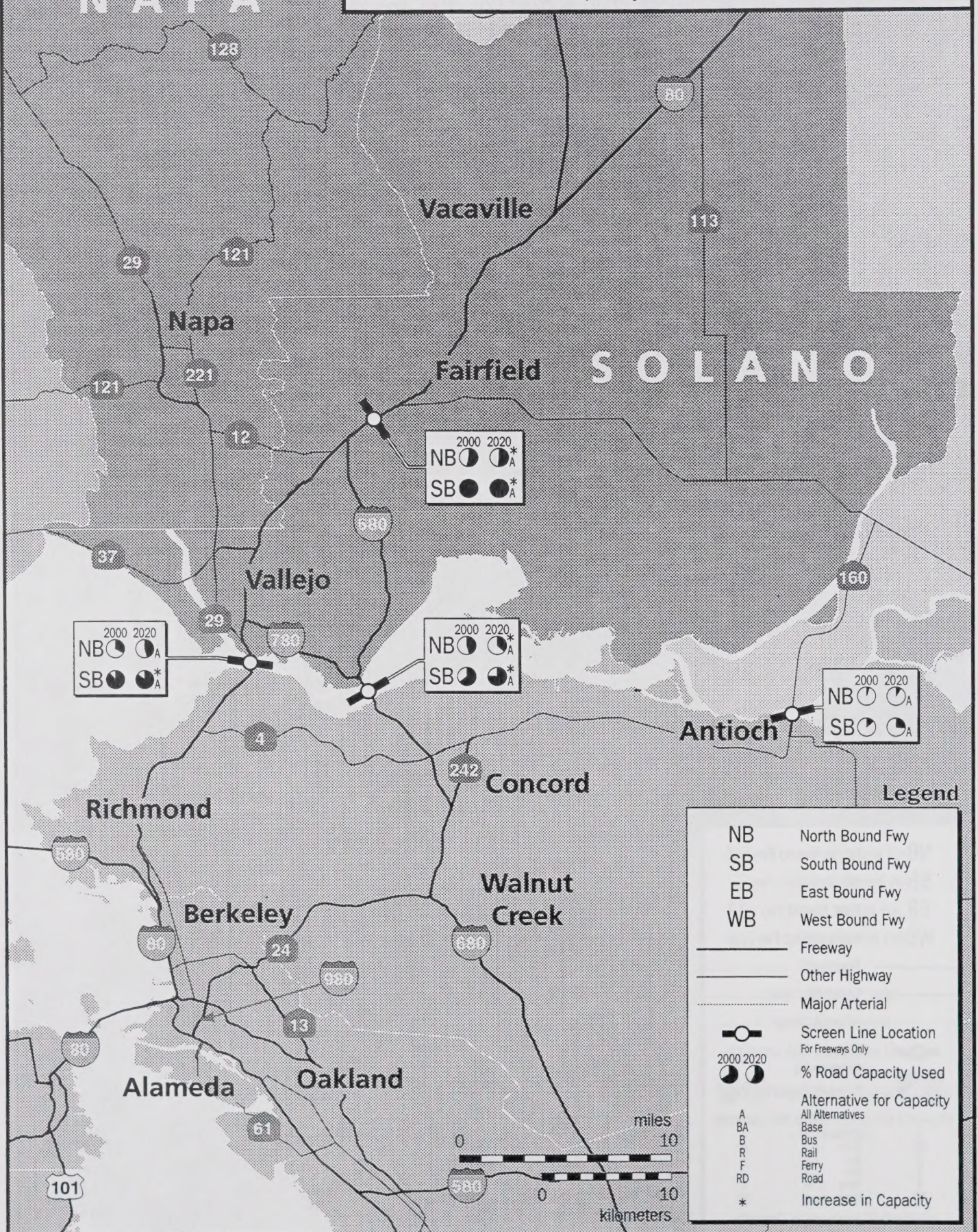
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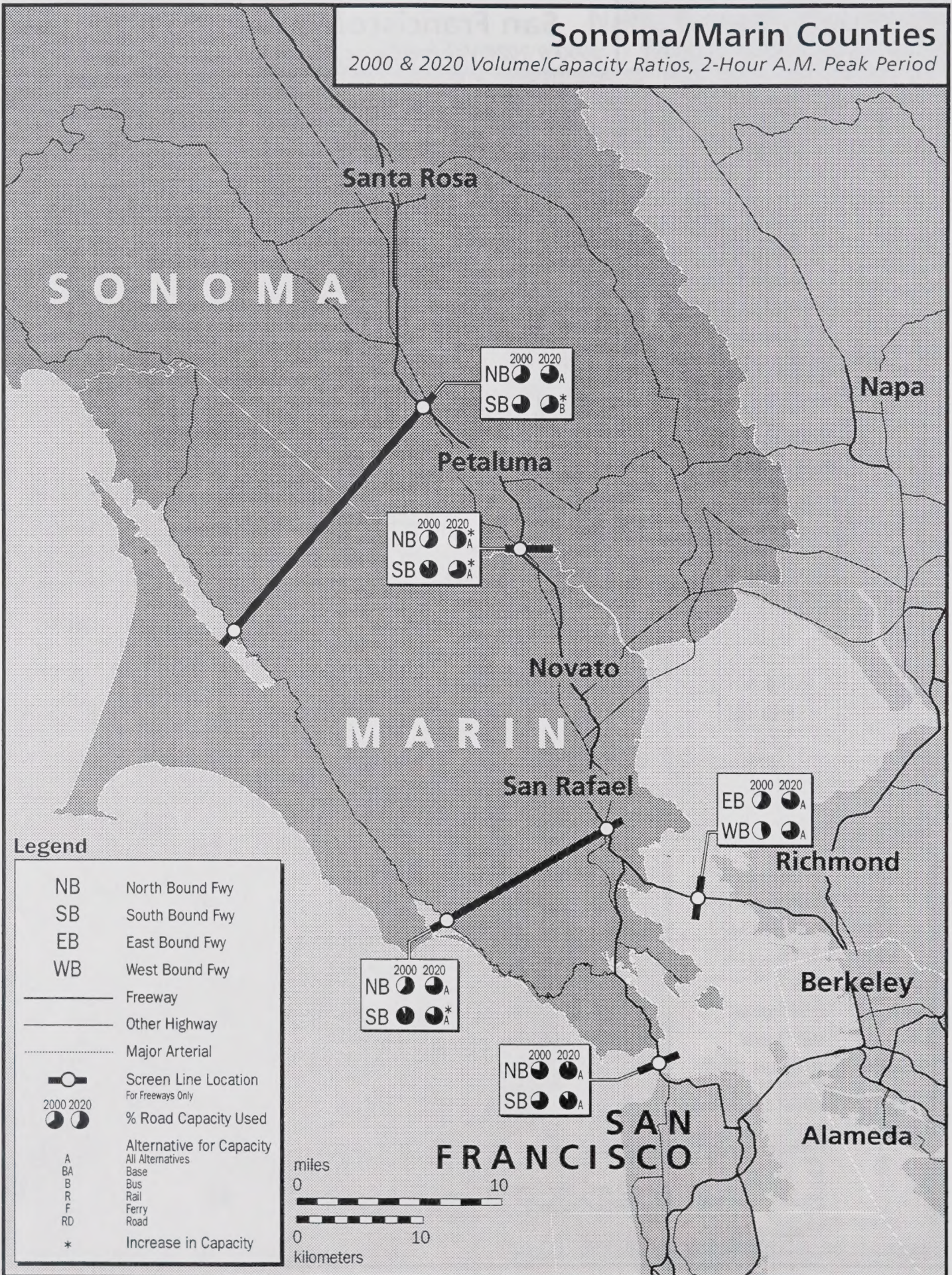
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